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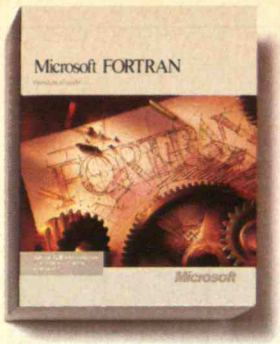
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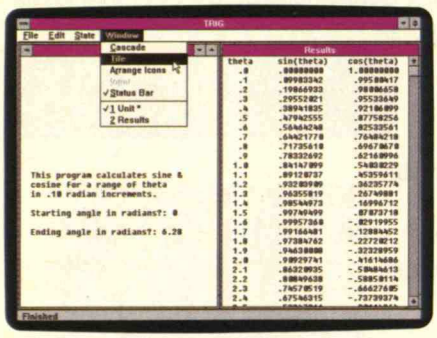
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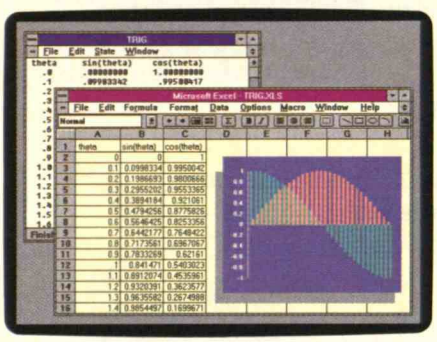


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PROGRAMMER'S TIPS

- *Use the /MW option with the FL command to invoke the QuickWin library. For example: "FL/MW MYAPP.FOR" is all it takes to make MYAPP a Windows-based program.*
- *Use the ALLOCATE statement to dynamically size arrays and to access more than 16MB of memory on a 386.*

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First Line

Shutting Down the Ghetto

ACCORDING to a recent study by the Scientists' Institute for Public Information, science journalism in the United States is on a downward spiral. SIPI found that the number of weekly newspaper sections devoted to features on science and technology has dropped from a high of 95 in 1989 to 47 in 1992 and, as reported in its quarterly *SIPIscope*, that "most of those remaining are not in very good health."

"The overall impact" of the decline, concludes Fred Jerome, SIPI's executive vice-president, "is likely to be less science coverage." He cites Joel Greenberg, science editor of the *Los Angeles Times*, who calls it "a major loss for science."

Yet where exactly is the loss? On the one hand, Jerome suggests, the diminishment will adversely affect coverage of "the critical science policy issues facing our nation (e.g., science education, federal funding priorities, fetal tissue research, retooling our industrial base)." On the other hand, he observes, "such issues have *not* been the focus of most newspaper science sections, which have tended instead to emphasize medical discoveries, technological inventions, and breakthrough-of-the-week stories"—what editors often dismiss as "gee whiz." The situation recalls the Catskills one-liner: "The food in this hotel is *poison*—and in such small portions!"

Some observers are therefore unalarmed. "I'm not mourning the decline," says Ben Patrusky, executive director of the Council for the Advancement of Science Writing. "Dealing mostly with health and medicine, the science sections didn't have so much science in the first place." And as Jerome notes, "some veteran science writers have long held that 'ghetto-izing' science in a separate section cuts off many readers from important stories," and that without such sections "science will actually get better coverage."

Nils Bruzelius, editor of the "Health/Science" section of the *Boston Globe*, maintains that while a science section may be a ghetto, "if it's a *nice* ghetto, with good graphics and journalistic 'value added,' it provides a home base for science in the paper" and a useful anchor for interested readers. Patrusky counters that science sections "are as much *ex*clusive as *in*clusive," since stories confined to the ghetto tend to be "encyclopedic" while those reporting the news appear elsewhere. And although such "educational" stories may be valuable for teachers and students—Jerome laments the decline of the science sections as a particular loss for grade schools—most adult readers greet them as the kiss of death. Says Patrusky: "They're *homework*—more of a turn-off than a turn-on."

Sprung from specialized newspaper sections and magazines, science reporting may be free at last.

Why am I, as editor of a magazine, talking about newspapers? Because science sections essentially are—or were—weekly magazines within newspapers; because their rise and fall so closely parallel the fate of science magazines created during the 1980s; and because the debate about general pages vs. ghettos is just as relevant to magazines.

Science journalism saw some moments of self-proclaimed glory during the 1980s, when writers, editors, and businesspeople alike discerned an enormous public appetite. They were right. But they were wrong to assume that concentrating science stories in special sections or magazines would be commercially viable. The audiences were often large, but not the right kind. Although students indeed loved these publications—I used to recycle my copies of *Discover* and *Science 80-x* to a friend's preteen daughter—they failed to attract enough adults who would in turn attract advertisers. Such has also been the lot of science sections in newspapers.

But these were merely "pilot projects," says Patrusky, from which good experimenters learn. And the lesson is that science-related stories don't have to self-consciously highlight their science content. Most grownups prefer their news whole—not segregated, predigested, annotated, or forcibly administered as necessary medicine. The general interest in science, therefore, should largely be addressed in the general pages of newspapers and in general magazines.

In fact, "there is a certain value to 'generalist' newspeople," said Jerome during a seminar at MIT in 1979, shortly after the Three Mile Island accident. "They feel what the general public feels, they doubt what the public doubts, and they ask the questions that the average person wants answered."

Technology Review is one of those general publications because it deals plainly with social, economic, and political questions; in so doing, it illuminates for the public many of "the critical science policy issues addressing our nation." And despite the science background of much of its staff, we are journalists not much different from "generalist newspeople" everywhere. Our aim is not to lay on the "gee whiz" but to present thoughtful, balanced, relevant, and timely articles to a demanding but generalist audience. When "education" is truly indicated, we deploy the most credible educators—expert authors—to do it; but even then the editors work closely with these sources to avoid tutorials and to tell a *story*, not for colleagues but for the public.

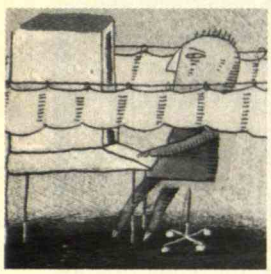
Science journalism is alive and well, not only in our own pages but in magazines such as the *Atlantic*, the *New Yorker*, and *Newsweek*, which cover even wider ranges of issues. And science and technology are well represented in your daily paper from front to back, often subtly or anonymously or even in disguise, but nevertheless manifesting their basic role in human affairs. ■

—STEVEN J. MARCUS

Letters

Privacy in Computing

In his thoughtful article "Of Bytes and Rights" (*TR November/December 1992*), Herb Brody describes the dark forces on the horizon in networked computing. But he neglects to mention some facts that counterbalance those forces. First of all, with regard to nodes such as electronic bulletin boards, imagine that we are talking about houses, shops, and other buildings interconnected by streets instead of computers hooked into a network. Some buildings may have no doors at all, while others might have the flimsiest of barriers, such as rice-paper curtains, and still others may have metal doors and concrete walls. Information systems can be set up in a similar way. Establishments like hospitals, police stations, and banks that deal with critical personal data should be required to have a minimum security level. And no establishment should have in public view material that society would regard as offensive or dangerous. But beyond that, people who use computers on networks should be free to install protective mechanisms or not as they see fit.



Say you are at the "gateway" of one of these electronic establishments. The door may be open and it may have no signs whatsoever. Will you enter? Obviously, that will depend on your values, style, courage, beliefs, habits, and other personal characteristics. If you do enter and you see unspeakable or unbearable sights, get out . . . just as you would in the street. And if you want to be totally safe, ask someone what the place is like before entering, or don't enter at all.

Also, the fearsome image of an evil person charting your entire life by using your social security number and searching over the nation's databases for your whereabouts is unrealistic. The first and biggest safeguard against this is the inherent difficulty of finding such information: when little is known about a person, there are just too many computers to be tapped. And even if the right computer can be found, it may be hard to penetrate, either because of its protective barriers or, more frequently, because different systems have different ways of filing and indexing information. The problem is so serious that even large companies complain that they cannot find the information they need within their own computer systems. And, mind you, they have the advantage of knowing how they organized these systems and what they are looking for.

MICHAEL L. DERTOUZOS
Director
Computer Science Laboratory
MIT

Keeping the F-22 On Track

Members of Congress would do well not to take the advice David Callahan offers in the "The F-22: An Exercise in Overkill" (*TR August/September 1992*). If they move the F-22 to the back burner until needed, they could face formidable problems. They would be loath to turn on the $100 billion program to build the craft until there was a threat so far developed that they could show pictures of it to the folks back home. Unfortunately, this could be years beyond the first clear intelligence indications. And then there is the sheer amount of time it takes to produce an aircraft—full-scale development for the F-22 started last year, but the plane won't be available until 2001.

Also, Mr. Callahan writes nothing about the capabilities of the F-22 in the most likely scenarios. We know that politics in our ally countries may preclude a U.S. base of operations next to, or even close to, a future conflict. Therefore, we'll need air superiority with reduced numbers of aircraft, long ferry ranges without inflight refueling, and the ability to operate efficiently from austere bases. These are unique F-22 attributes.

PAUL A. WIESELMANN
Los Angeles, Calif.

Sununu's Mindset

In "The Political Pleasures of Engineering" (*TR August/September 1992*), John Sununu displays at least four fundamental misconceptions. First, the assertion that there is no scientific basis for concern about global warming flies in the face of a broad consensus among atmospheric scientists. The Intergovernmental Panel on Climate Change estimates an average surface warming of 1.5 to 4.5° C over the next century in a business-as-usual scenario, with higher-than-average warming in temperate northern latitudes.

Second, the assertion that the United States cannot significantly reduce its CO_2 emissions without harming the economy runs contrary to both historical experience and a number of recent studies, including one from the National Academy of Sciences. The U.S. economy has grown by almost 60 percent since 1973 with no increase in CO_2 emissions. There is no reason to think that this trend cannot continue. My organization, the Alliance to Save Energy, recently joined the American Gas Association and the Solar Energy Industries Association in issuing a report that shows how more rapid deployment of energy-efficiency, renewable-energy, and natural-gas technologies could bring U.S. CO_2 emissions for 2010 12 percent below 1990 levels with no reduction in economic growth. Indeed, if we do not meet this challenge, we will lose world markets to our competitors.

Sununu's third misconception is that environmentalists want to stop economic development. In truth, mainstream environmental organizations have embraced the concept of sustainable development, which recognizes that economic growth and environmental protection are interdependent. The environmental community is working with industry to identify and promote new technologies that will simultaneously strengthen the economy and protect the environment.

And finally, Sununu's fourth misconception is that government has no major role to play in dealing with economic

and environmental issues. The fact is that only government can make the market pay for the social costs and benefits of different options. Ideally, that job would be done through mechanisms such as pollution taxes rather than command-and-control regulations.

WILLIAM A. NITZE
President
The Alliance to Save Energy
Washington, D.C.

WHY VOC-ED MATTERS

We at the U.S. Department of Education share Ray Marshall and Marc Tucker's concern about training the work force (*"Building a Smarter Work Force, TR October 1992*). The Tech-Prep Associate Degree Program, which the department funds and supports, is already prompting structural change in schools. Tech-Prep integrates academic and vocational education and provides a course of study that lasts four or more years and results in a certificate or degree in an occupational area.

Tech-Prep does not train narrowly; it seeks to develop workers with broad math, science, and communication skills, a desire to learn, and a good understanding of the workplace. Through the framework of Tech-Prep, communities can design successful school-to-work transition schemes that include career development and job placement. Work-based learning programs such as youth apprenticeship, cooperative education, and internships play an important role.

In conjunction with the U.S. Department of Labor, we are funding consortia representing business, industry, labor, and education to develop world-class skill standards for specific industries. For the first time we will have clear goals for training and will be able to measure ourselves against our global competitors.

BETSY BRAND
Assistant Secretary for Vocational and Adult Education
U.S. Department of Education

Marshall and Tucker would have done well to address a problem I remember from my own high school experience—the rigid divisions between college-bound and voc-tech curricula that can keep college-bound students out of courses aimed at teaching how to hammer nails, fix faucets, repair cars, and perform other basic work. Had it not been for a major revolt among the college-bound juniors at my high school, I would not have been allowed to take a course in typing and might still be computer-illiterate.

FREDRIC S. BERGER
Washington, D.C.

COLOR-BLIND TECHNOLOGY

I enjoy reading *Technology Review*. I'm disappointed, however, that we are almost into the twenty-first century yet the people in the photos accompanying the articles are pure white. I thought Boston was an international city. Also, as we all know, technology is color blind. So show it already.

R.C. CZAPIEWSKI
North Hollywood, Calif.

NURSES AND STEREOTYPES

Suzanne Gordon's "The Importance of Being Nurses" (*TR October 1992*) no doubt struck a strong chord with every nurse who read it. Real nurses, such as the ones Gordon writes about, bridge the mysteries of high-tech medicine and the frailty of the human condition. Through their efforts, anxiety gives way to reassurance, fear is replaced with safety and comfort, and death is transformed into deliverance.

Yet stereotypes do not die easily, and the nursing profession suffers as a result. The idealized vision of nurses as angels of mercy stationed at the bedside is a reflection of a kinder, gentler, and less technological age. No nurse is this perfect. At the other end of the continuum is the menacing Nurse Ratched of *One Flew over the Cuckoo's Nest*: a kind of Darth Vader character in a starched white uniform who taps into the primitive fears associated with feminine figures gone awry—fears that are particularly strong in situations where people are vulnerable. And as if that weren't enough, nurses

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are also represented as nubile airheads in porno movies, day-time soap operas, and prime-time TV shows such as *Nightingales* (which thankfully folded several seasons ago after the producers, networks, and sponsors were bombarded by complaints from nurses and professional associations).

Most members of the public don't find out what nursing actually entails until they or a family member becomes a patient. Knowing that I am a nurse, people I've met socially have often talked about how much a nurse once helped them, their mother, husband, or best friend. These stories are shared with an air of "insider" knowledge, and with respect for the nurse's primary contribution to either the recovery or the dignified death of a loved one. Unfortunately, however, these real-life encounters have not yet laid the stereotypes to rest.

NANCY M. VALENTINE, PhD, RN
Administrator for Nursing
McLean Hospital
Belmont, Mass.

THE HOW AND WHY OF AGING

The statements Michael Rose makes in "Finding the Fountain of Youth" (*TR October 1992*) need to be put in perspective. It's especially important to understand that gerontological theory may be bundled into two sets: the why approach and the how approach. The why approach, of which Rose is a representative, draws mainly on evolutionary theory and contends that adverse physiological changes late in life are not "selected against" because reproduction tends to occur before those changes can set in. The how approach, on the other hand, studies the actual mechanisms that might help bring on such changes—everything from mutations to wear and tear.

Perhaps the key difference between these two approachs reduces to the level of the explanations being sought. Why-approach researchers seek truly global predictions. But investigators of specific functions are happily absorbed in their grotty details and don't feel the need for a transcendental theory. Many are enthusiastically studying the causes of abnormal growths during aging; others are trying to find out how diet restriction slows aging in rodents, or why Huntington's and Alzheimer's genes cause specific kinds of degeneration. In contrast to Rose, most of these workers—I am among them—sense no "intellectual collapse" in gerontology. In fact, we tend to be more optimistic than ever because advancing technology allows us to pry more effectively at the complexities of aging in our favorite organisms. It matters not if each animal is its own model; we want to find out how it works, how it ages, and what can be done about it.

CALEB E. FINCH
Andrus Gerontology Center
UCLA



AUTOMOTIVE AUDIOPHILES

Thomas Magliozzi may be an expert car mechanic, but he's no audiophile, as is clear from his article "If It Ain't Broke, Don't Break It" (*TR October 1992*). The graphic equalizer, which he derides, is truly one of the best-designed human interfaces in consumer electronics. The equalizer's easy-to-use sliders allow drivers to adjust a car's audio system without taking their eyes off the road.

I'm sure Magliozzi would prefer the rally instrument grouping with tachometer, vacuum, and oil pressure gauges. But I'll take my equalizer instead.

DAVID DIAMOND
Mt. Laurel, N.J.

In "If It Ain't Broke, Don't Break It," Magliozzi wishes for a refrigerator with a central axle and rotating shelves. In 1955 General Electric had just such a refrigerator on the market. Our family bought one, and last year, when we gave it away because we were moving to smaller quarters, it was still in good working order.

YVONNE B. BROWN
Camp Hill, Pa.

New Titles from Technology Review

Do's and Taboos Around the World

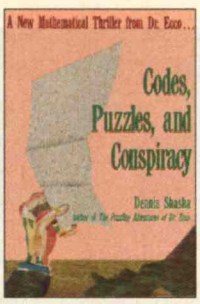
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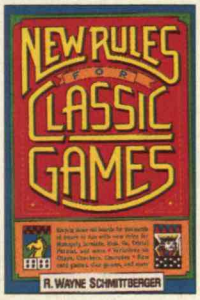
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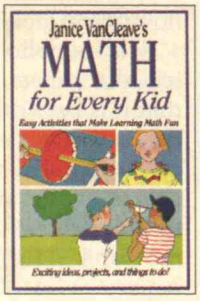
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by Janice VanCleave



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by Steven Caney



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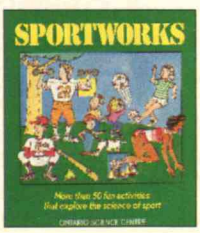
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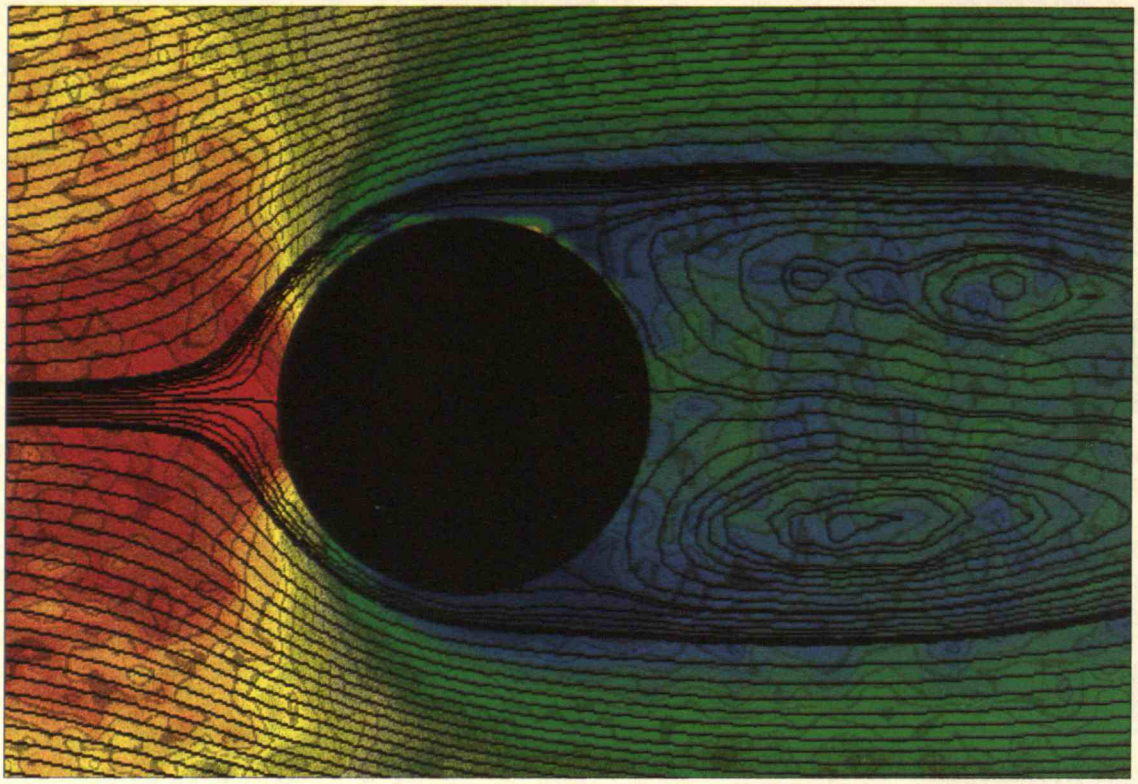
Charge my: ☐ Visa ☐ MasterCard

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Exp. Date: _____

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MIT Reporter



A new mathematical system, reflecting the mechanics of colliding molecules when air flows around objects, may reduce the need for extensive amounts of wind-tunnel testing. For the cylinder at left, red indicates the greatest pressure, blue the least.

A New Way to See the Way the Wind Blows

With a fair degree of accuracy, computers can predict the strength of a bridge span or display the structure of a drug molecule. But one only needs to watch a TV weather report to sense how far computers have to go in their ability to track atmospheric flow. Even trying to model how air passes around an object becomes highly uncertain as soon as turbulence becomes a factor, notes Paul Rubbert, head of aerodynamic research at Boeing. Hence, every new jet wing still has to be tested extensively in wind tunnels, at a cost of several thousand dollars an hour.

To try to reduce the amount of wind-tunnel testing, a team headed by Kim Molvig, a theoretical physicist at MIT, has created a mathematical system called Aerodynamica that the team claims can calculate on supercomputers and desktop computers alike the flow of molecules.

Most computerized flow calculations start with a theory of how fluid circulates under different conditions. To describe the numerous possible curving paths of so-called fluid particles in a complex flow, the theory relies on a series of difference equations that break the smooth curves into small, discrete steps. Each such calculation results in a tiny error. When many millions of paths are calculated by this method, the errors can add up to a significant deviation, says Molvig.

Aerodynamica, by contrast, is based on a 20-year-old mathematical technique known as the lattice gas method. This approach divides a volume of fluid into discrete parcels, and treats each parcel as though it were an individual molecule. It then relies on basic laws of physics to predict how the parcels will bounce off one another or other obstacles within a three-dimensional lattice.

By accounting for factors such as the slight compression that occurs when molecules hit one another, Molvig says, Aerodynamica can produce an average flow of parcels in any region of the lattice that is virtually identical to the average flow of real molecules in such an area.

Molvig, who has not yet published scientific papers on his approach, claims that it is better than other calculations for computing fluid flow because it relies on "a physical system that has all the characteristics of real air" while other techniques rely on numerical approximations. And, he adds, his system requires at least 1,000 times less computational work.

Previously, other researchers had limited success when they tried to use the lattice gas method to efficiently simulate the kinds of turbulent fluid flows that interest many engineers. Molvig claims that the underlying problem was that the method did not account for all the inherent thermodynamic properties of air at a microscopic level. To resolve this, Molvig says he applied knowledge—reflecting the mechanics of how molecules exert pressures on one

PHOTO: EXA CORP.

another—that he gained during MIT fusion research on the behavior of hot ionized gas.

One researcher who has seen preliminary papers from Molvig's team is Bruce Boghosian, a senior scientist at Cambridge-based Thinking Machines Corp. who has used the lattice gas method for several years. Because actual findings from some wind-tunnel research have compared closely with fluid-flow simulations by Aerodynamica, Boghosian agrees that "in many cases it might be able to eliminate testing in wind tunnels."

Molvig has recently taken a leave from MIT to commercialize his technique. He has raised nearly $1 million to start Exa Corp. and recruited computer scientists and engineers from IBM, Alliant Computer, Motorola, and MIT to refine the software his team developed into a commercial product and possibly design integrated circuits to make computers more efficient at running Aerodynamica. If the effort succeeds, Molvig has a chance to penetrate an important market: he points out that of the approximately $3 billion annual market in supercomputers, nearly $1 billion worth of hardware and software are bought primarily to model fluid flow.

—RICHARD BRANDT (The author is a reporter at Business Week *who recently completed a Knight science journalism fellowship at MIT.)*

SEARCHING FOR ANSWERS TO ALZHEIMER'S DISEASE

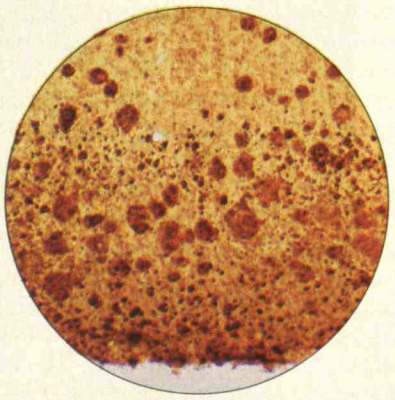
At the moment, no proven diagnostic test exists for Alzheimer's disease. Doctors diagnose patients through a battery of psychological and motor tests that rule out other possible causes for the memory and learning deficits characteristic of the ailment. The disease, which afflicts about 4 million U.S. residents, can be positively confirmed only at autopsy.

But two MIT researchers in the Department of Brain and Cognitive Sciences, Roger Nitsch and Richard Wurtman (who also directs the Clinical Research Center), have now devised what they hope will be a reliable test. And they have found evidence of a link between two biochemical abnormalities found in Alzheimer's victims, research that could have important implications for the development of an effective drug treatment.

The test grew out of a study Nitsch completed last spring. He compared samples of brain tissue from Alzheimer's patients at autopsy with similar samples from people of the same age whose deaths were not related to brain disease. He found that the brains of the Alzheimer's victims had higher levels of two products called GPC and GPE, which form when cell membranes break down.

This research suggested that GPC and GPE levels could serve as "biological markers" for the disease. Nitsch subsequently determined that abnormally high levels of GPC could be detected in spinal fluid drawn from living Alzheimer's patients. The MIT researchers have patented a test for diagnosing the disease by measuring both GPC and GPE levels, assuming that abnormally high levels of the latter can also be detected in spinal fluid. The test involves the use of chromotography, a chemical technique for separating components of a solution.

Plaques (brown) form in the brain (yellow) of Alzheimer's disease victims. A loss of the compound acetylcholine, which is essential for memory, may spur plaque development.



The MIT test "is an interesting lead," says Zaven Khachaturian, associate director for neuroscience at the National Institute on Aging. But he notes that because the disease process isn't uniform in all patients, not all victims may have abnormal levels of GPC and GPE in their spinal fluid. He also points out that other researchers have recently reported progress in identifying biological markers that could be used for diagnosing Alzheimer's, although none has yet proven completely reliable.

Nitsch and Wurtman, who have been collaborating with other Boston-area scientists, are now conducting clinical studies of their test and are studying whether higher levels of GPC and GPE show up in the blood or urine of Alzheimer's patients. Sampling those fluids, which carry many breakdown products of the body, would be easier.

The MIT scientists hope their test could identify Alzheimer's before telltale symptoms such as memory loss appear. By that time, the patient may have had the disease for as long as 30 years and so many brain cells will have died that any treatment has little chance of success.

On the Trail of a Treatment Strategy

Besides developing a method for diagnosing the disease early on, researchers must find a drug that will stop or at least slow the degenerative process. Wurtman says that he and Nitsch have uncovered new evidence that if a compound closely mimicked acetylcholine—a chemical that acts as a messenger among cells in the brain—it might prove to be an effective Alzheimer's drug.

Researchers have known for several years that acetylcholine, which is essential for memory, is deficient in Alzheimer's patients. (It has not been possible to test for the disease in living people by measuring acetylcholine levels because there's no way to easily examine the amount of the chemical in the brain.) Wurtman and Nitsch have discovered that this deficiency may also spur the development of the plaques that form in the brains of Alzheimer's patients.

PHOTO: BRADLEY HYMAN

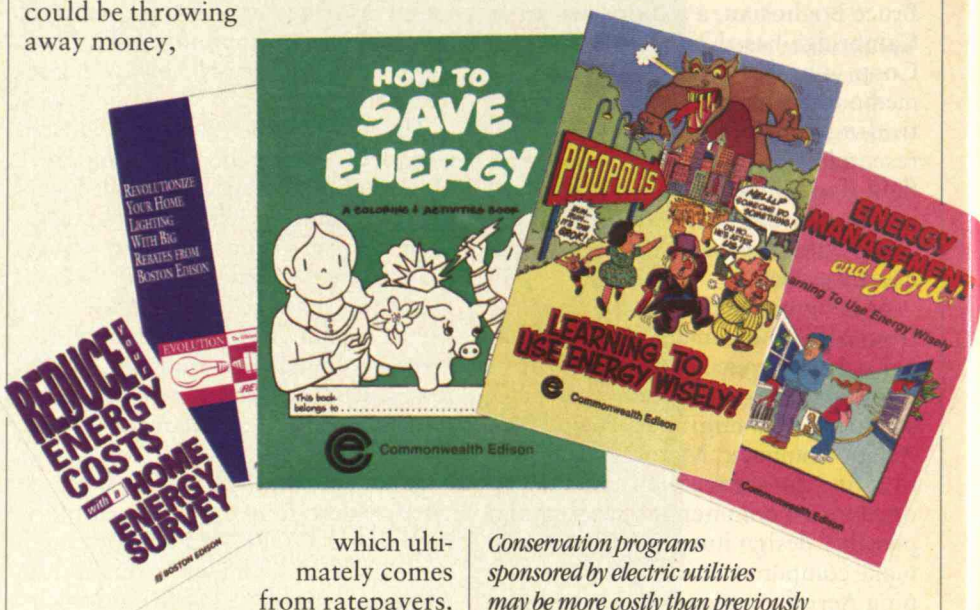
These plaques are composed of protein fragments called beta amyloid. The formation of beta amyloid depends on how the body breaks down a protein called amyloid precursor protein, or APP. If the body breaks down APP by a "good" pathway, the substance is cleaved in a way that results in no beta amyloid. A second, "bad" pathway chops up APP in a way that beta amyloid is produced. In Alzheimer's patients, more APP is processed by the latter pathway, and the beta amyloid clumps together to form plaques, Nitsch says.

Working with cell cultures, Nitsch and Wurtman have found that the act of acetylcholine binding with protein "receptors" on a cell's surface member triggers a cascade of chemical reactions that turn on the good pathway. If the acetylcholine is absent, the APP is much more likely to be shunted down the bad pathway. This research, Wurtman says, suggests that if given early enough, an acetylcholine-like drug might stop the formation of the protein plaques and also remedy memory and learning deficits. The next step will be to try to duplicate Wurtman and Nitsch's findings in animals. —*ROBERT WHITAKER (The author, a reporter for the* Albany Times-Union, *is currently a Knight science journalism fellow at MIT.)*

THE REAL COST OF SAVING ELECTRICITY

Each year, in an attempt to meet the growing demand for electricity without building expensive new generating plants, utilities spend hundreds of millions of dollars encouraging customers to use less "juice." This can involve giving factory owners rebates for reducing power loads or buying them more efficient motors, and also providing homeowners with efficient fluorescent bulbs.

In theory, these conservation programs cost much less than the electricity they save. Not so, say Paul Joskow, an MIT professor of economics and management, and graduate student Donald Marron. Their analysis of 10 programs nationwide suggests that utility-sponsored efforts may be far more expensive than conventional thinking assumes. If the finding is accurate, then utilities could be throwing away money, which ultimately comes from ratepayers. And energy planners can't bank on the vast electricity savings projected by experts.



Conservation programs sponsored by electric utilities may be more costly than previously thought, according to Paul Joskow and Donald Marron of MIT's Department of Economics.

The work contradicts two widely quoted estimates. Amory Lovins, the guru of energy conservation and director of research of the Rocky Mountain Institute (RMI) in Snowmass, Colo., says that investments in energy-efficient technologies can cut electricity use by 75 percent or more at an average cost of just 0.6 cent per "negawatt" (each kilowatt-hour saved). That's roughly one-tenth the cost of generating a kilowatt-hour. The Electric Power Research Institute (EPRI) more cautiously pegs conservation potential at around 30 percent, at a cost of 2.6 cents per negawatt.

But, says Joskow, "no one really knows how much a negawatt costs." Both the RMI and EPRI numbers are based on simple calculations—comparisons between more energy-efficient technologies and older, less efficient ones. The figures are "notoriously inaccurate," he says, because they ignore other costs.

These include energy-conservation programs' overhead, administrative and marketing costs, incentive payments to consumers, and measurement and evaluation costs. Joskow and Marron also factored in hidden costs such as time spent shopping for energy-efficient appliances and company downtime encountered while installing new motors, as well as the impact of "free riders"—people who would have invested in energy efficiency on their own but took advantage of the utility program as a bonus.

What the MIT economists found was an enormous spread in the price of conservation efforts. The cost for programs aimed at residential customers ranged from 0.6 to 181.4 cents, averaging 7.9 cents per kilowatt-hour saved. By comparison, the average retail price of residential electricity is about 8 cents per kilowatt-hour. Commercial and industrial programs cost significantly less, varying from 0.2 to 18.4 cents and averaging 3.3 cents per negawatt, compared with today's average retail price of 5 cents per kilowatt-hour.

According to Joskow and Marron,

PHOTOS: BOSTON EDISON, COMMONWEALTH EDISON

these numbers should be considered the lower bounds, since the utilities they polled regularly failed to account for all administrative costs. More important, utilities rarely measured the actual impact of their programs on energy savings because of the difficulty in doing so—there's no such thing as a negawatt meter.

But Lovins maintains that "the MIT study is way off the mark. It is possible to find lousy programs, which they have obviously done." Utilities should use this research, he says, only to help them adopt cost-effective programs and avoid the others.

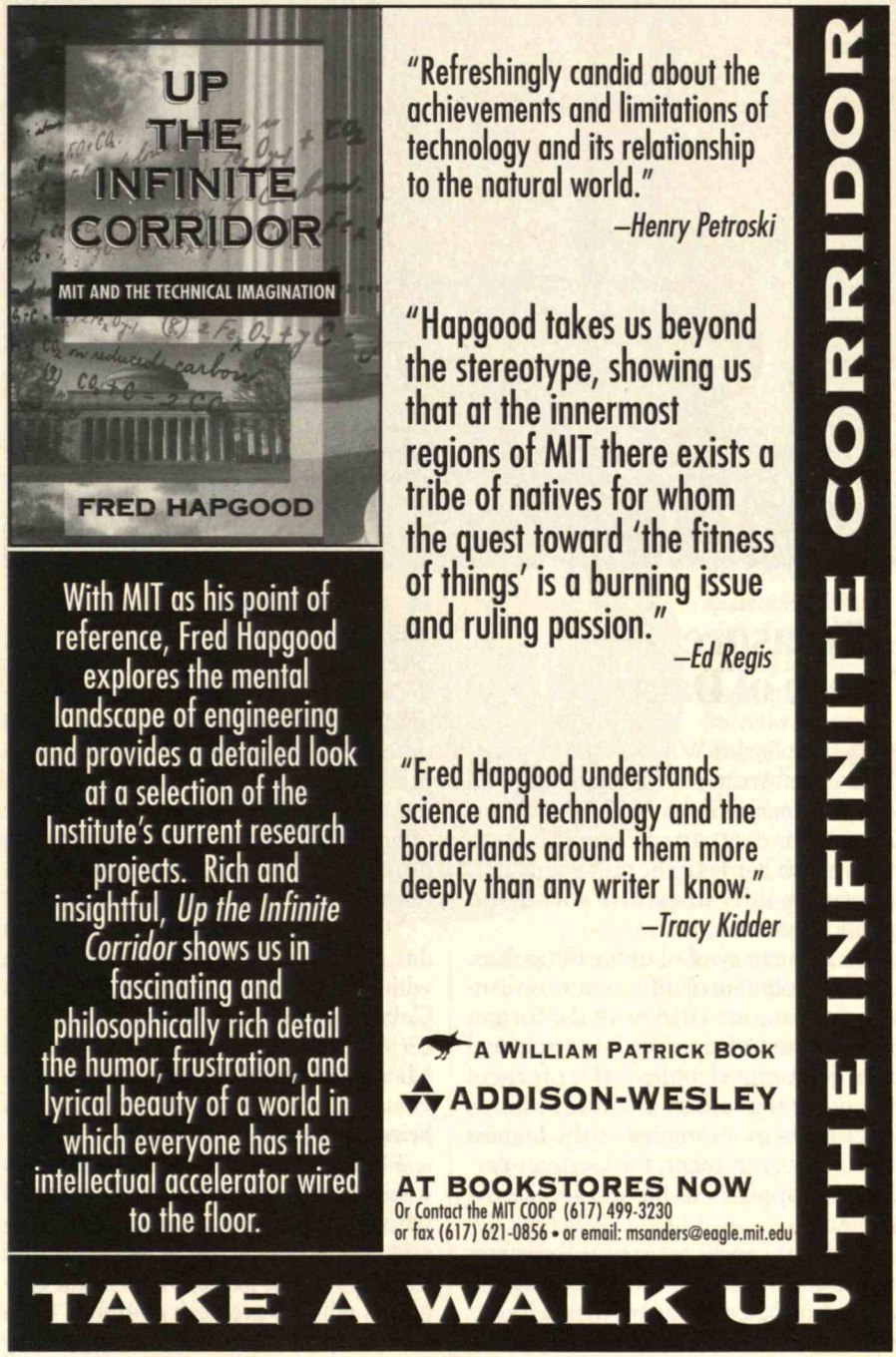
Philip Hummel, manager of EPRI's demand side–management program evaluation, sees a bigger impact for the study. Its contribution, he says, is in "raising the question of whether utility subsidies are the most efficient vehicle for stimulating customers to conserve electricity."

Instead of paying home and business owners to invest in energy-efficient technologies, utilities should help break down the barriers that keep consumers from doing this on their own, says Joskow. The barriers can be as simple as a lack of information about inexpensive measures such as wrapping hot water heaters with insulation. Utilities may also get a better return on investment, he maintains, by sponsoring research on energy-efficient appliances, lighting, and heating systems. The Golden Carrot program, for example, sponsored by the Environmental Protection Agency and utilities nationwide, offers a reward to the company that manufactures the most miserly electric refrigerator.

"There's no reason that electric companies should shoulder the conservation burden alone," Joskow adds. Banks could provide low-interest loans to encourage consumers to install energy-saving technologies that require high initial investments but whose savings dribble in over years. He also recommends that federal and state governments—together the country's largest energy consumers—invest in technologies that reduce energy use in their office buildings and subsidized housing. Encouragement along these lines should come both from the savings potential and the fact that the national energy strategy passed by Congress in 1992 requires conservation by governments.

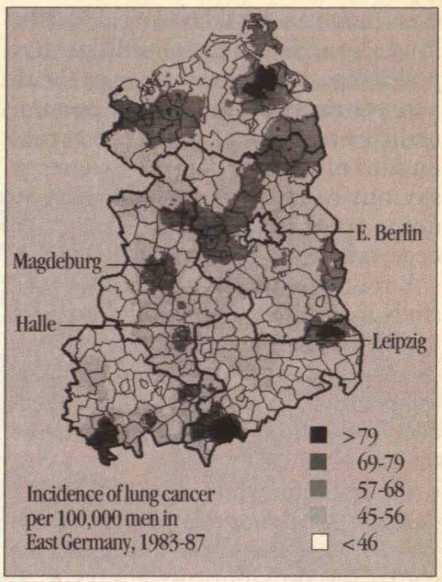
Joskow notes that some people have branded his study as anticonservationist. But nothing could be further from the truth, he says. "Increasing energy efficiency will be important for our economy. We just wanted to make sure people know the real cost."

—*P.J. Skerrett*



Trends





Cancer records from former East Germany are helping epidemiologists study links between the disease and environmental factors. The data show that lung cancer was most common near uranium mines along the south central border and near cities with high levels of air pollution, such as Leipzig (left), Magdeburg, and Halle.

A Treasure Trove of Data

The Berlin Wall has all but vanished from the formerly divided city, but tearing down the physical barrier was the easy part of German unification. Much harder is the task of integrating two wildly disparate social and political systems.

As a potent symbol of the difficulties, a small mountain of information on cancer rates among citizens of the former East German Republic has remained idle, quarantined in the Berlin offices of the Federal Ministry of Health. Now, after years of wrangling at the highest levels of government, the German parliament appears to have resolved the dilemma.

The vast cancer registry at the center of the controversy is by all accounts an epidemiological treasure trove. Its 2.2 million files contain detailed medical data about some 95 percent of all cancer cases in East Germany over nearly four decades. The problem is that the information, which include names and much other personal information, was compiled without patients' consent. The database's very existence violates the privacy laws—some of the strictest such provisions in the world—that now hold throughout all of Germany.

"Our constitution says you can't give data on any person to an institution without that person's consent," explains Gabriele Hundsdorfer, head of the Cancer Abatement Division of the Federal Ministry of Health in Bonn. "Every individual must know if such information is being transferred."

Matthias Möhner, a researcher at the Institute for Cancer Research in Berlin who helped create the cancer registry and now presides over it, responds that cancer registries in the former West Germany, which have been compiled from voluntary information, are plagued by reporting rates of around 50 percent—too low to offer the kind of information epidemiologists seek. "A high level of privacy is good for the individual," Möhner says, "but cancer is a central health concern in our society, and the community may suffer for the lack of information."

Fearing the loss of a significant scientific resource, the German parliament recently passed an act to save the cancer registry, which will relax some privacy provisions and thereby allow the study of the registry and continued collection of data under strict guidelines. The new law stipulates that names and identification numbers be separated from epidemiological data. The database will also be placed under federal control for two years so that all new information from the six eastern German states—now gathered with patients' informed consent—can be closely monitored.

Möhner and others anticipate performing a variety of studies on the links

PHOTO: REUTERS/BETTMANN; CHART: BGA

between environmental factors and cancer. Work prior to unification indicated, surprisingly, that lung-cancer rates in some of eastern Germany's most notoriously polluted areas were no greater than those in areas with the lowest levels of air pollution.

Also of interest, Möhner says, is an analysis of the influence of the health care system on cancer survival rates. Some East German cancer patients received high-tech treatment such as radiation therapy and advanced forms of chemotherapy in specialized hospitals while others were treated in general hospitals. Möhner and others further believe that valuable information could be gleaned about the incidence of secondary cancers, such as in patients who contract leukemia after being treated initially for breast cancer.

Linking Cancer and Radiation

Much of the database's promise, though, lies in linking specific environmental and occupational exposures to particular clusters of people. One such case involves the possible correlation between lung cancer rates and occupational exposure to radiation among some 50,000 uranium miners in southern East Germany. "This information was restricted by the government in former times, but we would expect to see a high incidence of lung cancer among these workers," Möhner says, adding that such an undertaking would entail "one of the biggest studies of the effects of human exposure to low levels of radiation."

Such a study, like others that spring from the East German cancer registry, would satisfy more than scientific curiosity. Should a strong correlation be found between lung cancer and employment in uranium mines, for instance, lawsuits initiated by workers are almost a certainty. "Good analyses of the health data will further our understanding of the causes of disease," Möhner says. "But I would like to think that the information could also do something for some of the patients themselves."

—*SETH SHULMAN*

Solid Progress in Hydrogen Storage

For years, research on the practicality of using hydrogen, the world's most abundant element, as a clean fuel source has focused on separating the gas from water. Not any more. "We're realizing that without good storage technology, hydrogen's uses are limited," says William Hoagland, manager of the U.S. Department of Energy's hydrogen program. In fact, Hoagland says, the agency plans to devote almost half its hydrogen budget to storage systems, primarily for cars and trucks, over the next five years.

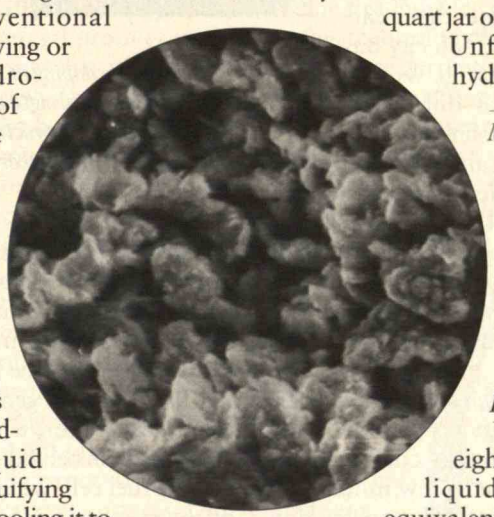
The perfect storage system for transportation would be light, compact, cheap, safe, and easy to use, and would hold plenty of hydrogen. That's a tall order. Conventional methods of liquifying or compressing hydrogen—the lightest of all gases—have proven impractical for transportation applications because they require hefty energy input and heavy, bulky cylinders.

BMW has tested engines modified to burn liquid hydrogen. But liquifying hydrogen means cooling it to a more than icy -252°C, which costs four times more than making an equivalent amount of gasoline. On top of that, liquid hydrogen must be kept chilled even when a car is parked, so that the fuel won't boil away.

Compressed hydrogen gas is much cheaper than liquid hydrogen and has been used to power the Green Car, a sporty fuel-cell-powered electric vehicle built by Energy Partners in West Palm Beach, Fla. But the fuel is much bulkier than liquid hydrogen: even at 6,000 pounds per square inch, tanks of compressed hydrogen capable of supplying enough fuel for 350 miles would take up 4.5 times the space of a gasoline tank.

New developments in storing hydrogen as a "solid" in combination with other materials, and then liberating the gas on demand through chemical reactions, have begun to show promise. One technique is to loosely bond the gas with a relatively inert partner called a metal hydride. The concept is simple: bathe the metal in hydrogen and it splits the two-atom gas molecules; the individual hydrogen atoms are bound to the metal until it is heated.

At the Florida Solar Energy Center in Cape Canaveral, research chemist Darlene Slattery and her team are looking exclusively at magnesium hydrides that hold almost 7 percent hydrogen by weight. A quart jar of the gray powdery hydride holds as much hydrogen as a quart jar of the liquified gas. Unfortunately, the hydride weighs about eight times more than liquid hydrogen or an equivalent amount of gasoline. Also, hydrides must be heated to more than 300°C before they give up their bound hydrogen. Slattery believes that doping magnesium with nickel or other metals, or alloying it with aluminum, may lower the weight and operating temperatures to practical limits.



Magnesium hydride powders hold huge quantities of hydrogen—nearly 7 percent by weight—which can be released as pure hydrogen gas for use as fuel when the powders are heated.

An alternative solid-storage approach is to use superactivated carbon—a material similar to the highly porous activated carbon used in water filters—which can gently hold hydrogen molecules at sub zero temperatures. The colder the carbon, the less heat that's needed to disturb

PHOTO: FLORIDA SOLAR ENERGY CENTER

the weak forces holding the carbon and hydrogen together. The beauty of this system, first developed at Syracuse University a dozen years ago, is the extraordinary surface area potentially available for adsorption. If it were possible to flatten a single gram's worth of these tiny carbon particles, they would cover about 2,300 square meters—nearly two-thirds the surface of a football field.

The current version of carbon storage calls for a series of small, pressurized cannisters chilled to -120°C. Tiny temperature and pressure swings are used to pull hydrogen away from the carbon, says Jack Schwartz, director of the Laboratory for Advanced Storage Systems for Hydrogen at Syracuse. He estimates that a carbon-storage system for a city bus with a 300-mile range would weigh about 850 pounds—only 200 pounds more than a full gasoline tank.

However, constant refrigeration—even while a vehicle is parked—would be needed to keep the gas from leaking out. Research into modified activated carbons that hold hydrogen more tightly may raise the operating temperature and minimize this energy drain, says Schwartz.

The solid-hydrogen storage technique that seems to be generating the most excitement in the energy community is being developed just a few miles from where the hydrogen-filled zeppelin *Hindenburg* met its explosive end in 1937. A small company called H-Power in Belleville, N.J., has devised a system that liberates hydrogen from the reaction between powdered iron and water. Thanks to the addition of catalysts, the reaction occurs far faster than the rusting of a scratched fender. Inventor Joseph Maceda, who is also vice president of H-Power, says this storage scheme would occupy only one-third the space of compressed hydrogen and cost even less than gasoline.

If a driver were to press down on the gas pedal, a burst of steam would spray over a bed of brownish powdered iron, also called sponge iron, packed into long tubes. The hydrogen gas that immediately forms would be injected into a fuel cell, which would generate a current for the electric motor, while the rusted iron would remain behind.



Techniques for doping magnesium hydride with nickel to lower its weight and hydrogen-releasing temperatures to practical levels are being investigated by researcher Darlene Slattery.

(The fuel cell, which is driving much of the research in hydrogen storage, works much like a conventional battery in that it has a positive and negative electrode, separated by an electrolyte. When hydrogen gas is squirted into a chamber containing the negative electrode, electrons are stripped from the gas and used to power the electric motor. The electrons then complete their circuit at the positive electrode, where they combine with free oxygen atoms from air and with hydrogen ions that have made their way through the electrolyte. The only by-products of this process are water and trace amounts of nitrogen oxide.)

When the tank of sponge iron that would supply hydrogen to the fuel cell is "empty," meaning all the iron has been oxidized, the driver would pull into a service station, empty out the iron oxide, fill up the tank with fresh iron and water, and drive away. "Recharging wouldn't take any longer than filling up a gas tank does now," says Maceda.

The spent iron oxide can be converted back to pure iron by reducing it with carbon monoxide made from natural gas, or with hydrogen generated by solar-powered, water-splitting electrolyzers. Recycling the iron will cost 60 percent less than an equivalent amount of gasoline. "If you just rust it and chuck it after a single use," he says, "it still costs 10 percent less than gasoline."

According to H-Power's calculations, the iron/rust fuel system can store 25 times more electrical energy per pound than the typical battery. This could take some of the burden off engineers trying to design ultra-lightweight car bodies and motors. Working with Rolls-Royce, H-Power plans to scale up its laboratory prototype for road testing by 1994.

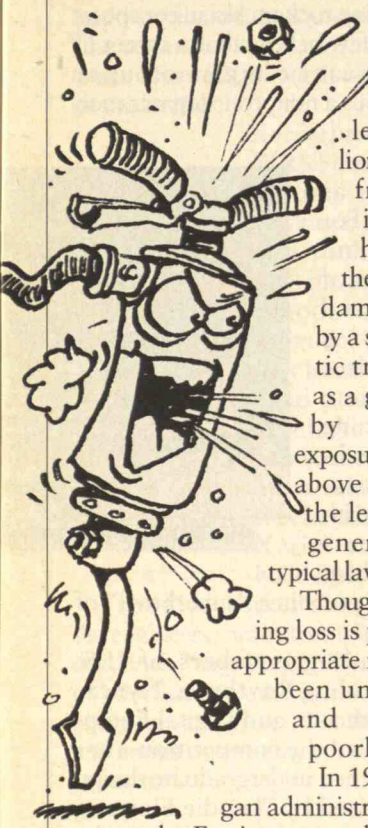
One technical hurdle is that the system must be warmed up to several hundred degrees before the self-sustaining hydrogen-producing reaction can occur, according to Arthur Kaufman, president of H-Power. The developers are therefore investigating ways to lower the operating temperatures and to supplement the system with a conventional lead-acid battery to enable cold starts, he says.

Larger versions of the iron-storage system could be used for a home-sized fuel cell Maceda dubs the Total Energy Module. This 2-kilowatt machine could generate the electricity and hot water needed by a typical household. "I think we'll eventually be able to reduce home power generation to something the size of a big appliance, the kind of thing you buy at Sears and have serviced by Maytag," he says.—*P.J. SKERRETT*

PHOTO: ROBIN FLYNN

A Quiet Investment

As the din at work and home grows louder, a growing number of Americans are finding that their world has turned silent. According to the National Institutes of Health, at least 10 million now suffer from noise-induced hearing loss, the irreversible damage caused by a single acoustic trauma such as a gunshot, or by prolonged exposure to sounds above 85 decibels, the level of noise generated by a typical lawnmower.



Though such hearing loss is preventable, appropriate research has been underfunded and legislation poorly enforced. In 1982 the Reagan administration closed the Environmental Protection Agency's Office of Noise Abatement Control, which spent $10 million annually during the 1970s on noise research and enforcement. At the same time, federal noise-research centers were also shut down, and Occupational Safety and Health Administration agents were directed to avoid citing any company that required engineering controls to solve their noise problems.

One bright spot in this gloomy picture has been the work by industrial researchers to develop practical noise-reduction technologies. While most of the recent efforts have been motivated by industries and product manufacturers in Europe—where tough noise standards are strictly enforced—some products are beginning to prove their value in the United States. And given the prospect of practical and affordable noise-dampening technologies, the U.S. government may soon begin to reconsider long-dormant noise-control laws.

One U.S. company that has led the way, holding more than 100 product-muting patents, is Noise Cancellation Technologies of Stamford, Conn. NCT's claim to fame is a low-cost electronic technique that silences noisy products or processes not by conventional methods (of insulating or muffling sound) but by "canceling out" noise with devices that generate identical sound waves 180 degrees out of phase.

An Elegant Solution

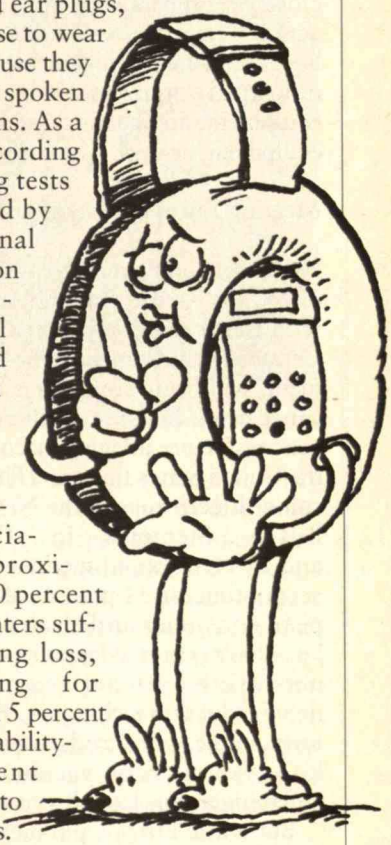
Last June, NCT and Walker Manufacturing, the largest producer of exhaust systems in North America, began selling an "electronic muffler" for buses, the first major commercial product in the United States that uses this active noise-canceling technology. The new muffler contains a controller box, about the size of a Sony Walkman, with a digital microprocessor that analyzes exhaust noise. The processor interprets sound from the engine and generates the "anti-noise" wave. Speakers then broadcast the antinoise signal throughout a sealed chamber that envelopes the tail pipe. A sensor at the end of the tail pipe detects any noise that "escapes" cancelation—say, because of changing engine conditions. The microphones feed the information back to the processor, which triggers another wave of antinoise, further silencing the muffler.

Walker claims that the mufflers reduce truck and bus noise by 35 to 50 percent and that, because engineers are able to use a straight exhaust pipe that reduces the back pressure normally created by a curved or baffled pipe, fuel efficiency is improved by 5 percent and horsepower by 10 percent.

"For certain classes of noise problems, active noise cancelation is an elegant solution," says James Jones, professor of mechanical engineering at Purdue University. Passive techniques, such as acoustic foams, cannot block low-frequency noise because insulation barriers require a thickness one-fourth the length of the sound wave, he says. A 100-hertz tone, such as that generated by an industrial compressor, has a wavelength of approximately 12 feet. That would require insulation 3-feet thick, which would be impractical for foam-back wall insulation or ear muffs.

Another NCT product that may soon be marketed in the United States is a headset that selectively cancels fire-truck siren tones, diesel engine noise, and air-horn blasts—but nothing else—allowing firefighters to hear normal conversation while wearing the headphones. The unit cancels noise in the same manner as the muffler, though it generates the anti-noise waves at the ear based solely on the noise picked up by the microphones in the truck.

The fire industry is keenly interested in this technology because, while firefighters are currently issued passive ear muffs and ear plugs, many refuse to wear them because they can't hear spoken instructions. As a result, according to hearing tests conducted by the National Institute on Occupational Safety and Health and the International Firefighters Association, approximately 50 percent of firefighters suffer hearing loss, accounting for more than 5 percent of the disability-retirement payments to firefighters.



ILLUSTRATIONS: JON McINTOSH



Other U.S. developers of noise-abatement technologies and products include Bose, which manufacturers headsets to quiet airplane cockpits, and Lotus Engineering, a subsidiary of GM, which has focused its efforts on quieting automobile cabins.

Still, most of the noise-abatement activity has occurred in the European Community, where industries are quickly redesigning their products with active noise-cancelation features to meet strict pollution laws. "Great Britain, Austria, Switzerland, and Germany have set the pace in establishing tough building codes for sound transmission," says Clifford Bragdon, professor of city planning at the Georgia Institute of Technology. The EC also closely monitors land use and airport activity, regulates vehicular noise, and has established stringent standards for industrial compressors, construction equipment, and heating and ventilation equipment, he says.

Meeting European Standards

Not surprisingly, more than 70 percent of NCT's partnership agreements are with European companies. Siemens, a German manufacturer of medical equipment, will begin shipping active noise-cancelation headsets with every magnetic resonance imaging machine sold in the United States this year. Philips Consumer Electronics in the Netherlands, Bosch Siemens in Germany, and Electrolux in Sweden—together accounting for 31 percent of the European consumer and electronics market—have begun redesigning their products using both active and passive noise-reduction techniques. Electrolux, for example, will introduce quiet kitchen hood exhaust fans, vacuum cleaners, and refrigerators later this year.

But while Europe pursues a quieter environment and a potentially profitable environmental market, U.S. manufacturers languish. "Historically, quiet has not sold in the United States," says Kenneth Eldridge, standards director of the Acoustical Society of America. It costs money to add the extra screw or fiberglass layer that would reduce the vibration in a dishwasher, he says, and retrofitting poorly designed products, even with active noise cancelation, simply adds to the cost of the product.

The good news is that, given the possibility of a practical and more affordable noise-control technology, Capitol Hill is evincing renewed interest in noise abatement. For example, former Rep. Thomas McMillen wrote a provision into the recently approved 1993 Energy bill that calls for a 12-month demonstration project or feasibility study of active noise control.

Also, the Administrative Conference of the United States, which reviews administrative procedures of federal agencies, recently called on Congress to either repeal or uphold the stipulations of the 1972 Noise Control Act. When the Reagan administration cut off funding to the Office of Noise Abatement Control in 1982, "Congress and EPA may have violated administrative law by not enforcing the requirements promulgated under the Noise Control Act," says the author of the report, Sidney Shapiro, a law professor at the University of Kansas. Though the Administrative Conference filed its recommendation in the July 1992 Federal Register, it is still awaiting a response from EPA officials and members of Congress.

Georgia Tech professor Bragdon supports the Administrative Conference proposal, pointing out that the Noise Control Act required the ONAC to ensure that American products were competitive on the international market through their compliance with other countries' regulations. In fact, he says, the incentive to meet European standards may well lead U.S. industries into compliance with domestic laws and thus help quiet the American landscape.

—*JOHN OST*

I Was a Teenage Superstar—in Engineering

Today's teenagers often dream of becoming rock musicians or sports heroes, and few believe that a career in engineering can be as glamorous or rewarding. But a nonprofit organization of business leaders and educators known as U.S. FIRST (For Inspiration and Recognition of Science and Technology) is trying to alter that perception; it is heightening interest in technology by teaming students with real engineers and pitting them against their peers in a "superbowl" of engineering.



MIT/Boston Latin School (Bo

The founding members of U.S. FIRST, including Raytheon, Nynex, Baxter Healthcare, and Digital Equipment, modeled the competition after MIT's renowned undergraduate design contest, devised by Woodie Flowers, professor of teaching innovation in the School of Engineering (who serves on U.S. FIRST's board of directors). It was also inspired by the International Design Contest, more commonly known as Robocon, a global undergraduate design competition that recently grew out of the MIT contest. For these events, student are given identical boxes of materials and asked to build a machine that will perform a particular task, such as retrieving objects.

U.S. FIRST sponsored its first contest in February 1992, when nearly 30 teams of students and engineers from companies such as AT&T, Xerox, Motorola, and Boeing squared off in a gym in Manchester, N.H. The Maize Craze, as the contest was billed, required teams to build robots that could negotiate a ter-

rain covered with feed corn and other obstacles and collect as many tennis balls as possible in two minutes.

The teams had six weeks to construct their devices out of a box of miscellaneous materials including gears, motors, lengths of wood, and aluminum tubing. The teams were also allowed to purchase up to $200 worth of supplementary materials.



s.)

Xerox, cited by U.S. FIRST for building a model partnership between a company and a school, joined with the Joseph Wilson School, an inner-city magnet school in Rochester, N.Y., to field a team for the event. About 20 Wilson students worked after school and on weekends with 20 Xerox engineers to build their robot.

"The kids worked side by side with the engineers, brainstorming and setting deadlines," says Eugene Wicks, manager of community education and college programs at Xerox. "For them, it was a real hands-on experience of developing a product."



Xerox/Joseph Wilson School (Rochester, N.Y.)



Nypro/Clinton High School (Clinton, Mass.)

In the "superbowl" of engineering, nearly 30 teams composed of students and professional engineers competed to design a robot that could traverse a table of feed corn and collect the most tennis balls. By showing that engineering can be both a challenge and fun, contest organizers hope to attract more students to the profession.

It was also a valuable experience for Xerox, Wicks adds. "We were looking at ways to reduce our time to market, and I think we gained some ideas out of this," he says. For example, some Xerox employees handled their engineering colleagues' administrative tasks during the U.S. FIRST competition, freeing them to focus on engineering. The success of that strategy prompted Xerox to look for ways to divert or eliminate the considerable paperwork load of engineers for any given project.

U.S. FIRST's founder, Dean Kamen, president of Deka Research and Development (a medical-instrumentation firm in Manchester, N.H.), emphasizes that the partnership between students and world-class engineers is the heart of U.S. FIRST's competition. He hopes the experience will give students a taste of the thrill of using their minds in intellectual contests and provide them with a glimpse of what technology professions are actually like.



Boeing/Lindbergh High School (Seattle, Wash.)

Students seemed to get the message. "For me it was a complete turnaround," says Jon Payne, a former high-school student from Clinton, Mass., who worked on the winning team with Nypro. "I didn't like school very much, I didn't know anything about engineering, and I never planned to go to college." Payne's Maize Craze team traveled to Washington, D.C., to attend an award ceremony with President Bush. Now Payne is attending a junior college and hopes to transfer to the University of Lowell to major in engineering.

His team built the winning entry with an open front end of six evenly spaced disk wheels that trap the tennis balls and lift them into an open container at the rear of the robot. The robot was slower but more maneuverable and efficient than other designs, most of which tried to pick up the balls with a front-end-loader-like scoop and dump them into a repository.

U.S. FIRST intends to host another contest in 1993 and hopes to double the number of participating companies by 1994. Kamen would also like to convince soft-drink and consumer-product companies that sponsor traditional heroes to help hype the heroes that compete in the engineering superbowl. "It's all about awareness," says Kamen. "We want to get to kids to let them know that there are challenges and opportunities and fun in areas beyond sports and rock music."—*THOMAS KIELY*

PHOTOS: NYPRO; U.S. FIRST; CHRISTINE CUMMINGS

Intergalactic Conversations

If NASA's Search for Extraterrestrial Intelligence (SETI) project turns up a signal from life elsewhere in the universe, that would be profound enough. But the discovery would also open the door to intriguing possibilities such as engaging in conversations with civilizations across the galaxy.

Since last October, radio receiving dishes at the Goldstone Tracking Station in California's Mojave Desert and at the Arecibo Observatory in Puerto Rico have been scanning the cosmos for what space scientists believe is a likely possibility—a signal that is unmistakably of intelligent origin. In fact, given that conditions to support advanced life may well exist among the billions of stars in our own Milky Way galaxy, and that intelligent creatures could be as motivated to communicate with their neighbors as we are, researchers believe that the galaxy might be humming with conversation.



ET, phone our *home: This coded-message—beamed into the cosmos in 1974—includes information about the position of the earth, atomic weights of elements, the height of a human being, and chemical formulas for components of the DNA molecule.*

SETI explorers are concentrating their search for such signals among the millions of microwave frequencies because there are few natural sources of emissions in that range, and, researchers believe, extraterrestrials would thus recognize it as a quiet place for sending a message.

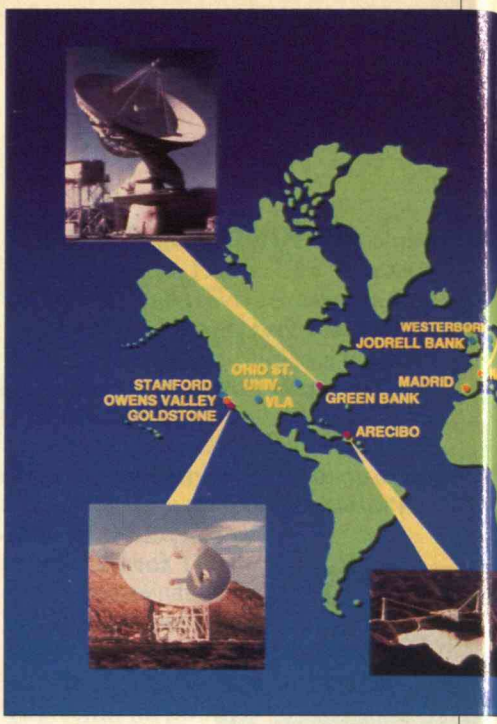
Such messages might take several forms, such as a steady tone concentrated over a narrow frequency, a pulsed tone with a highly regular pattern, or a complex pattern of coded information, none of which could be generated by a natural source. However, a more frustrating and perhaps more likely result, some believe, would be a promising signal that could never be found a second time or that was too garbled—from the scattering caused by interstellar dust and gases—to be clearly identified.

Nonetheless, researchers are discussing how they might react if they do detect a signal. In fact, scientific agencies from around the world have signed a protocol, developed by the International Academy of Astronautics, agreeing not to respond immediately. The approach, which is expected to involve people from a broad range of backgrounds, will be presented to the U.N. Committee on Peaceful Uses of Outer Space.

"We want to listen and learn before jumping into the conversation," says Michael Klein, SETI's associate director. One reason for caution is the possibility that earth might happen upon a hostile message, perhaps one sent between belligerent societies. In such a case, there might be no advantage in responding, even though the distance would probably be so great the aliens would not pose an immediate threat to earth, Klein says.

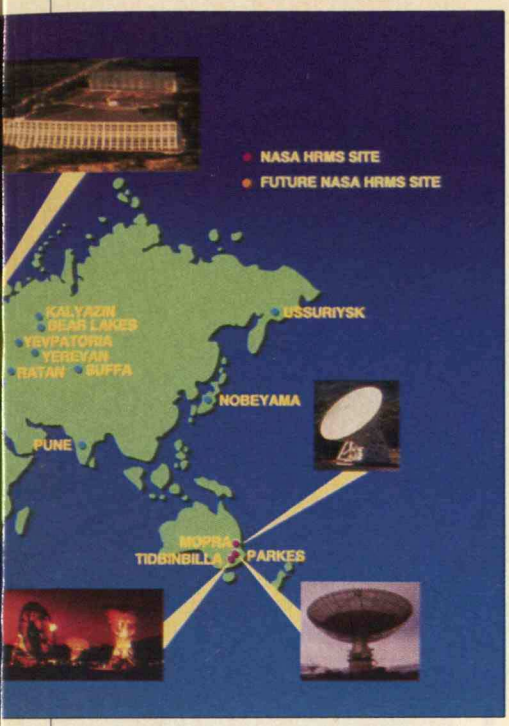
When time comes to reply, the technology is available. With the 1,000-foot diameter dish at Arecibo, it should be possible to transmit information as binary pulses across the galaxy, in a process that Frank Drake, an astronomer at the University of California-Santa Cruz and longtime advocate of SETI, likens to sending an interstellar fax. The NASA Deep Space Network of radio telescopes in California, Australia, and Spain, which tracks planetary probes, could be used to boost the signal.

The tougher questions concern how much information actually could be communicated between two alien societies. In the simplest case, earth might receive a message it could decode, then respond using the same code. But if earth initiated a conversation, one possible response might be in the form of pictures sent in binary code with instructions for laying out the ones and zeros to form the images, according to Carl Devito, a mathematician at the University of Arizona. By including captions with the



NASA has enlisted six high-resolution microwave survey (HRMS) telescopes (shown as purple dots), most of which will go on line before the middle of the decade, for its Search for Extraterrestrial Intelligence project. The agency plans to include several more telescopes in the search (orange dots), though it has not set specific dates, and would eventually like to sign up more than a dozen others (blue dots).

PHOTOS: SETI INSTITUTE



images, he believes, it may be possible to convey words and grammar, after which written messages could be sent.

There is a precedent for interstellar images: a three-minute transmission Drake sent during a dedication ceremony at Arecibo in 1974. When that binary information is plotted correctly, the decoded image depicts the position of the earth around the sun, a stick-figure person, information about human DNA, and the shape of the Arecibo dish.

One obvious obstacle to transgalactic communication is the time required for messages to transverse the enormous distances between the stars. If earth's neighbors are relatively near, perhaps 100 light years away, a lightspeed radio message and reply would take two centuries. If a civilization is 1,000 light years away, which scientists say is likely, earth might benefit only if it were receiving streams of information sent by that world long ago.

Other limitations may be even more daunting. For instance, even if we are able to communicate the complex ideas in, say, a Shakespearian play or discourses on love and humor, recipients may find the ideas unfathomable if they have no such concepts in their world. "Whether we can get across what it feels like to be human is really problematic," Devito says. "Maybe this is really the sense in which we are alone."

—*David Graham*

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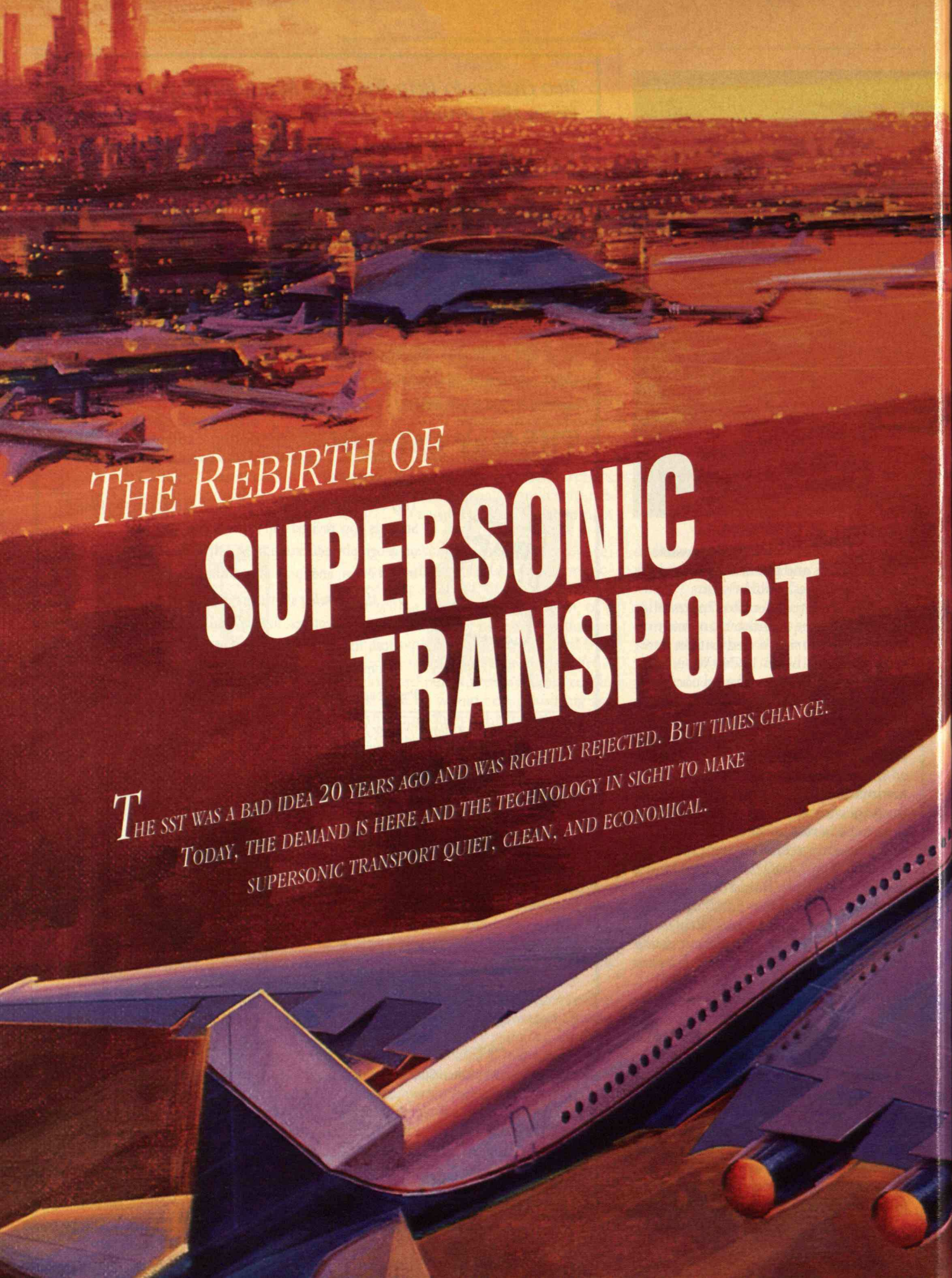
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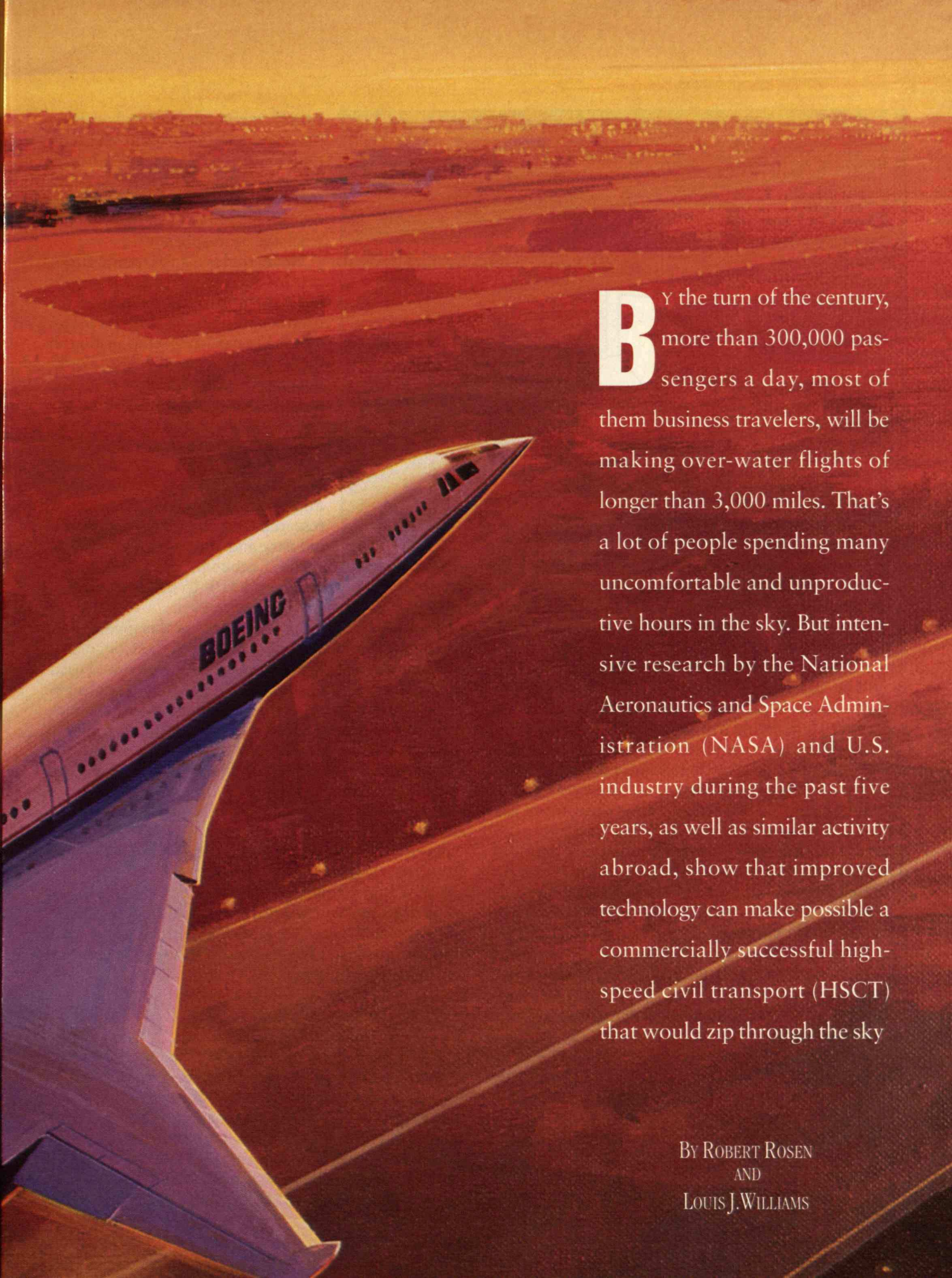
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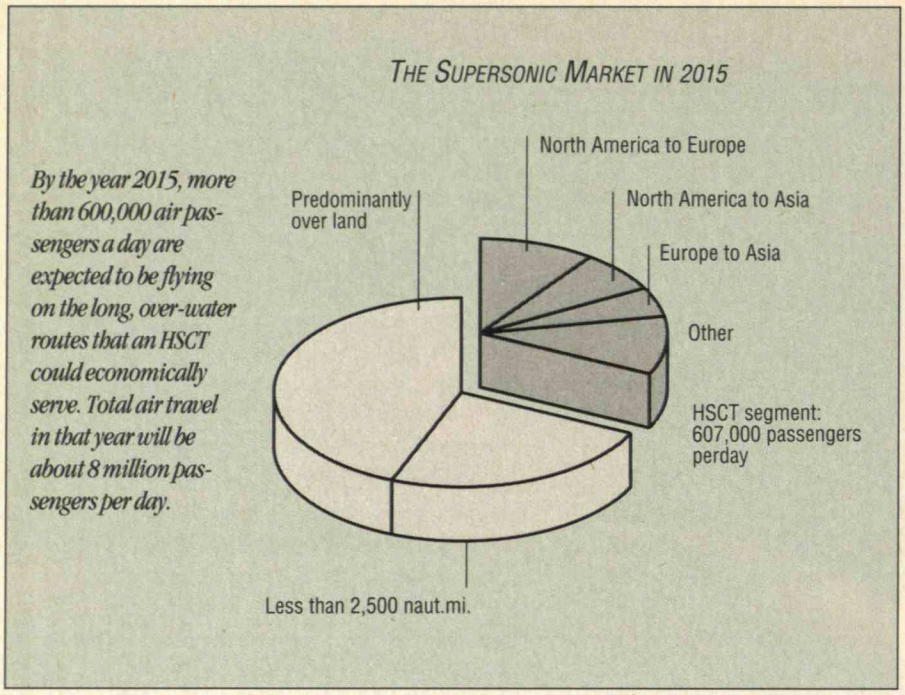
THE REBIRTH OF SUPERSONIC TRANSPORT

THE SST WAS A BAD IDEA 20 YEARS AGO AND WAS RIGHTLY REJECTED. BUT TIMES CHANGE. TODAY, THE DEMAND IS HERE AND THE TECHNOLOGY IN SIGHT TO MAKE SUPERSONIC TRANSPORT QUIET, CLEAN, AND ECONOMICAL.



BY the turn of the century, more than 300,000 passengers a day, most of them business travelers, will be making over-water flights of longer than 3,000 miles. That's a lot of people spending many uncomfortable and unproductive hours in the sky. But intensive research by the National Aeronautics and Space Administration (NASA) and U.S. industry during the past five years, as well as similar activity abroad, show that improved technology can make possible a commercially successful high-speed civil transport (HSCT) that would zip through the sky

BY ROBERT ROSEN
AND
LOUIS J. WILLIAMS



at greater than 1,600 miles per hour—more than twice the speed of sound and three times the speed of conventional jets. Flying on an HSCT, the trip from Los Angeles to Tokyo—a 10-hour ordeal on today's fastest commercial jet—would take barely over 4 hours. A movie, a nap, and a meal, and you'd be there. The time reduction would be less dramatic on shorter flights, but would average about 45 percent for any pair of cities that the supersonic plane would reasonably connect.

Such claims may seem to revive an idea that has already been rejected. The United States and other countries energetically pursued supersonic transport (SST) in the mid-1960s, but the United States abandoned the project before an aircraft ever flew. The French-English effort did produce the Concorde, a remarkable technical development and a beautiful airplane, still in operation after two decades of safe, reliable service. But the technology then available could not make supersonic transportation economically practical. Concorde can't go very far or carry many passengers, and it costs a lot to fly. Despite large fare premiums, it has never come close to commercial success.

In the United States, critics voiced legitimate concerns about the SST's cost and its effect on the environment. They said that only the very wealthy would be able to afford tickets—it would become a "toy for the jet set." Atmospheric scientists predicted that SST engine exhaust, particularly nitrogen oxides (NO_x), would destroy an appreciable percentage of the stratospheric ozone, dangerously raising the amount of solar ultraviolet radiation reaching the earth. (Although all aircraft engines emit some NO_x, subsonic planes fly too low for significant quantities of the pollutant to reach the stratosphere.)

Nevertheless, supersonic flight retains its appeal, since it would allow the airline industry to boost the number of passenger-miles it can handle per day while reducing time in the air for passengers. NASA, working closely with aircraft and engine manufacturers, is now at about the halfway point of a seven-year, $400 million program to develop technologies to ensure environmental compatibility. NASA estimates that about $4 billion of additional research—much of it carried out by industry and at universities—will be needed to make the HSCT economically viable. Industry would then need to spend $10–15 billion of its own to bring the supersonic plane to market.

To provide an acceptable return on this investment, the new HSCT would have to exceed the Concorde's performance considerably. A viable aircraft would need two-and-a-half to three times the Concorde's passenger capacity and twice its range. Its fares could be only modestly higher than those of subsonic transports, and it would have to meet stringent noise standards now in effect. Most importantly, the HSCT would have to be environmentally benign.

In an effort to meet these goals, major research is under way to:

- □ develop reliable predictions of an HSCT's effect on stratospheric ozone;
- □ reduce engine emissions of NO_x;
- □ develop significantly quieter aircraft and engines; and
- □ determine how well sonic booms can be softened to perhaps permit at least some supersonic flight over unpopulated land corridors.

Keeping the Ozone Whole

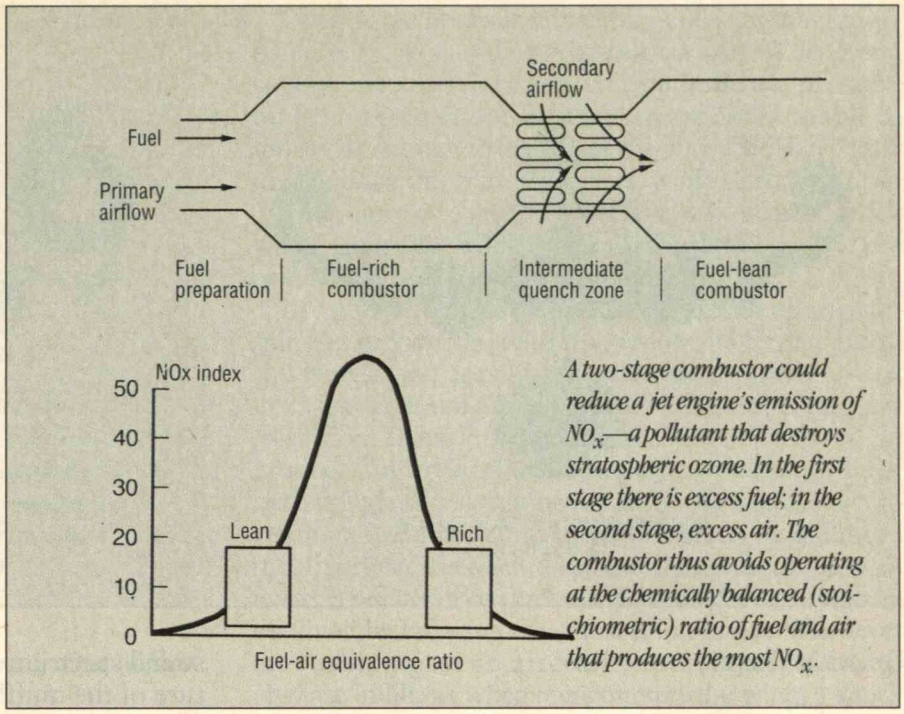
The 13 Concordes now flying have had no discernible impact on the stratosphere, but unless low-emission engines are developed, a large fleet of supersonic aircraft cruising at high altitudes could deposit significant amounts of NO_x there. NASA has thus devoted considerable effort toward understanding the physics and chemistry of the upper atmosphere. This work will provide a basis for setting maximum allowable engine emission standards.

ROBERT ROSEN, formerly head of NASA's aeronautics programs, is now associate director of its Ames Research Center. LOUIS J. WILLIAMS is director of high-speed research at NASA headquarters in Washington.

PHOTOS: BOEING

Recent analyses that account for the presence in the atmosphere of aerosols such as water droplets and various solid particles show that a fleet of HSCT aircraft may deplete ozone more slowly than previously predicted. This finding means that ultra-low-emission jet engines should be able to reduce NO_x pollution to acceptable limits.

The combustion chamber in a conventional jet engine, if operated at the temperature and pressure needed for efficient supersonic flight, would emit 45 grams of NO_x per kilogram of fuel consumed. NASA's goal is to reduce this so-called "emission index" to 5 grams per kilogram or less. With that improvement, a fleet of 600 HSCT aircraft flying at altitudes of 18 to 21 kilometers would remove at most 0.2 percent of the ozone from the upper atmosphere—a reduction most scientists believe would present little or no danger to life on earth.



A two-stage combustor could reduce a jet engine's emission of NO_x—a pollutant that destroys stratospheric ozone. In the first stage there is excess fuel; in the second stage, excess air. The combustor thus avoids operating at the chemically balanced (stoichiometric) ratio of fuel and air that produces the most NO_x.

But engineers face a basic tradeoff: most steps to cut emissions also degrade performance. To achieve the propulsion efficiency and low weight required for an economical supersonic aircraft, the engine combustor must operate at high temperatures and pressures—conditions that also increase NO_x production. Using today's combustor at the temperature and pressures needed for efficient supersonic flight could release enough NO_x to deplete the ozone layer by 5–10 percent.

To address this dilemma, NASA engineers are working on engine technologies that provide high overall burn temperature—a key to high efficiency—without creating local "hot spots" that tend to generate NO_x. Their basic tactic is to avoid burning at so-called stoichiometric conditions—that is, when neither fuel nor air are present in excess. Although a stoichiometric ratio provides the highest potential efficiency—which is important for commercial operation—it also burns hottest, and so produces the most NO_x.

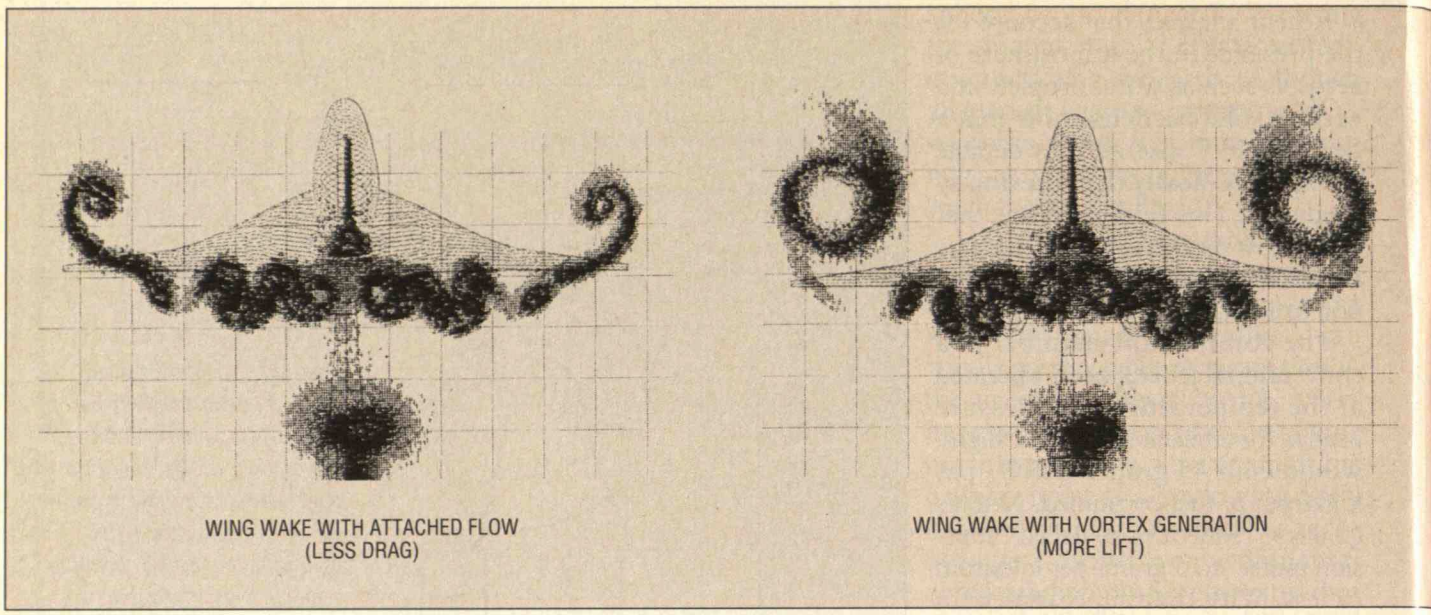
One approach premixes and prevaporizes the fuel and air—in a non-stoichiometric blend—upstream of the combustor. This mixture then burns at a high, uniform temperature. A problem with this design is that the flame from the combustor may travel back into the mixing zone and prematurely burn some of the fuel. Such "flashback"—which resembles knocking in an automobile engine—could shorten the combustor's life.

Another idea is to burn the fuel in two stages. First, the fuel itself would be ignited, with little air mixed in. This "rich" mixture would burn considerably cooler than the stoichiometric blend. But it would also leave a lot of fuel unburned. So the next stage would introduce a burst of air into the combustion chamber, and burning would be completed with this "lean" mixture. The engine would consume the fuel entirely without ever operating at the fuel-air ratio that produces high levels of NO_x.

Although the two-stage concept eliminates the possibility of flame flashback, it suffers from greater complexity. The two combustion stages also require a longer, heavier engine. Further research will focus on figuring out which of these two methods is most practical. But laboratory tests of both concepts have yielded encouraging results, indicating that the emissions goal can be achieved over a wide range of engine temperatures and pressures.

The HSCT in Perspective

	CONCORDE	U.S. SST	HSCT
Status	In service since 1971	Canceled 1971	R&D; may start service 2005-2015
Market	North Atlantic	North Atlantic	Worldwide
Range (naut.mi.)	3,500	3,500	5,000-6,500
Passengers	100	200	250-300
Weight (lbs.)	400,000	750,000	700,000
Takeoff noise (measured 21,000 ft. from start of runway)	120 dB	108 dB	104 dB



WING WAKE WITH ATTACHED FLOW
(LESS DRAG)

WING WAKE WITH VORTEX GENERATION
(MORE LIFT)

Quiet Up There!

One of the biggest objections to the original SST was that it makes an awful racket, even compared with other jets. And today's noise standards are far stricter than in the 1960s. Thus an HSCT will have to be 20 decibels quieter than the first-generation (Concorde) technology—a reduction of about 75 percent.

A supersonic transport creates two noise problems. One is sonic boom. The other is the sound of the engines, which affects communities surrounding the airports where the planes would take off and land. This noise can be reduced by modifying the engine and improving the plane's aerodynamics so that it can reach its cruising altitude quickly with a minimum of engine effort.

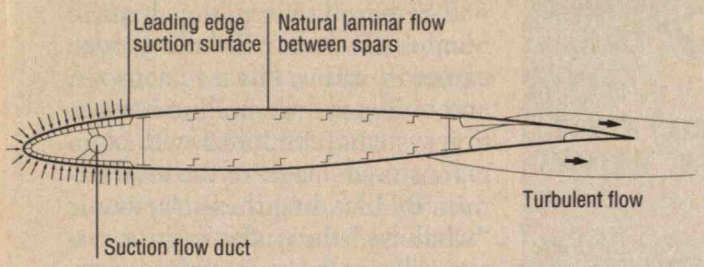
We have learned that the best way to reduce the engine's noise is to slow down the jet of air leaving the nozzle. This can be done by mixing in ambient air with the thrust-producing jet. But as with NO_x emissions, care must be taken to ensure that techniques to cut noise do not diminish the engine's performance: it is important to add enough ambient air mass to provide the same thrust at the reduced velocity.

Another noise-reducing measure complements this concept—covering the inside surface of the nozzle with a sound-absorbing liner. Because this muffler will need to withstand extremely high temperatures, it will have to be made of such advanced materials as intermetallic or ceramic composites or titanium aluminide alloy. It will have a honeycomb-like structure, and the shape of its cavities will determine which frequencies of sound it can best absorb. Design of the noise-reduction liners should be conducted in concert with engine development, since only by knowing the engine's sound spectrum can the designers optimize the structure of the muffler. Tests on small-scale models have shown that combining these two techniques can greatly moderate the HSCT's noise. Tests scheduled for 1995 will evaluate these technologies on large engine nozzles.

Ultimately, of course, the goal is not so much to make the aircraft quieter as it is to keep its noise from bothering people. Thus another noise-control tactic is to figure out how to make the plane rise more rapidly into the sky, thus shrinking the area on the ground subjected to high noise levels—the "noise footprint." Preliminary tests are encouraging, and they show that it should be possible to cut drag in half and still provide the lift required for takeoff.

NASA is studying several approaches to improving the lift-to-drag ratio. One is to reshape the wing so that its forward edge points slightly downward. This "droop" would force the air to rush more quickly over the wing's top surface, lowering pressure and thereby producing an upward force. Another approach would add flaps to the leading edge of the wing, creating a strong upward force.

Another promising method for improving the lift-to-drag ratio, particularly at cruise speeds, involves what aeronautic engineers call "boundary layer control." The goal is to ensure that air rushes past the aircraft in a smooth, "laminar" path, hugging the contours of the wing rather than forming turbulent eddies that create drag. One way to ensure laminar flow is to turn the wing into a giant vacuum cleaner. Thousands of tiny holes would perforate the wing, and a pump would apply suction so that air flowing past adheres closely to the aircraft skin. The suction power would vary from place to place across the wing's surface to precisely



AIRFOIL SECTION SHOWING LAMINAR FLOW CONTROL DETAILS

To reduce community noise, the HSCT must climb rapidly to its cruising altitude. One technique (above) is to sheath the wing with a perforated "glove." Suction applied through the holes holds air closely to the aircraft skin, thus lowering drag. HSCT researchers are also studying how to use the vortex that forms at a wing's leading edge to increase lift (left).

counteract the natural tendency of the adjacent airflow to become turbulent.

This idea, proposed some time ago, has only recently become practical. It presents a formidable manufacturing problem: providing just the right amount of suction at every part of the wing requires roughly 10,000 holes per square inch. While this is technically possible, the challenge will come in mass-producing such a structure inexpensively enough for the aircraft to make economic sense. Flight tests on a specially modified F-16 fighter have proven that suction-induced laminar flow works at supersonic speeds. When NASA outfitted the F-16 wings with metal "gloves" riddled with holes, and set up a vacuum system to provide suction, drag dropped significantly.

Anything that raises the lift-to-drag ratio will benefit the aircraft doubly—not just lowering ground-level noise but boosting flight efficiency. This degree of improvement, along with flight control systems that adjust flap and throttle settings automatically—another area of NASA research—should reduce community noise by as much as 5 decibels. That's a good start toward the overall goal of a 20-decibel reduction. Large-scale wind tunnel experiments and flight tests planned by NASA should verify the preliminary results.

The second noise problem of a supersonic transport is its ear-shattering boom. The Concorde flies supersonically only over the ocean so that few people have to put up with this phenomenon. But in developing the HSCT, NASA aims to soften the boom to a level that would perhaps allow supersonic flight at least over unpopulated land. Such flexibility would mean that the HSCT could plan to take a shorter flight path between cities or spend less time at subsonic speeds. This would open up many additional routes, enlarging the aircraft's potential market.

Some sonic boom is inevitable, since anything moving faster than sound creates shock waves. Whenever a supersonic airplane moves through the air, pressure builds up tremendously because the air is unable to move fast enough to get out of the way. The sharp nose of the classic supersonic aircraft, while sleek and aerodynamically efficient, produces a very strong shock wave. Altering the airplane's shape should, while not eliminating the boom, at least mute it.

Most low-boom designs attempt to break the ear-splitting thunderclap into a series of smaller, less intrusive bangs. One approach is to design the plane so that its cross-sectional area widens in a continous fashion from front to back. This gradual change in area would produce numerous shocks, but none would be as large as the single shock that comes from the front of a conventionally shaped supersonic aircraft. It would mean the difference between distant rolling thunder and an unexpected crash of cymbals. A similar effect could be obtained by tailoring the distribution of lift. Whenever air rushing past an aircraft experiences a sudden increase in lift, as when it encounters the wing, a shock wave results. Boom would be reduced by spreading the lift-generating regions more evenly around the aircraft.

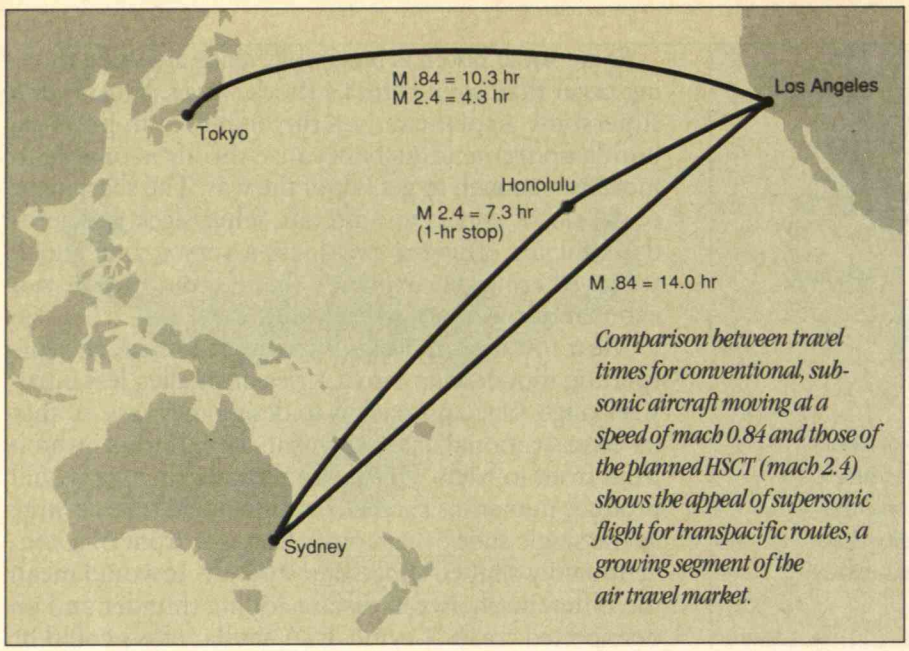
But again, there's no free lunch. Low-boom configurations appear to incur significant performance penalties. The needle-nose shape is common in supersonic aircraft precisely because it works so well: the plane slices through the air, minimizing drag. In fact, NASA's preliminary estimates indicate that because of the extra drag, a low-boom aircraft might have to carry 12 percent more fuel by weight than a standard-shaped plane to complete a 5,000-mile flight.

Therefore, despite continuing research on how to reduce sonic boom while preserving performance (conducted mostly at NASA's Ames Research Center in California and at Langley Research Center in Virginia), the first-generation HSCT will probably still be unable to fly supersonically over all land. But the boom may be softened enough to permit flight over a few areas of limited population.

Improving Performance

The current studies on ozone depletion and noise reduction are scheduled to end in 1996. But environmental compatibility alone is not enough to make a supersonic transport viable. Much work is also needed to develop the necessary propulsion, airframe, and flight systems that will make the aircraft economically attractive.

One formidable hurdle is basic physics: drag rises sharply as an aircraft breaks the sound barrier. In fact, at Mach 2, more than a third of the drag on a supersonic plane comes from the strain of overcoming its own shock waves. This higher drag forces the engine and the



Comparison between travel times for conventional, subsonic aircraft moving at a speed of mach 0.84 and those of the planned HSCT (mach 2.4) shows the appeal of supersonic flight for transpacific routes, a growing segment of the air travel market.

airframe to operate at higher temperatures, requiring costly materials such as high-temperature composites, titanium, and advanced aluminum alloys.

To develop and test high-temperature propulsion materials, NASA has assembled a team of companies—principally long-time rival engine-makers General Electric and Pratt & Whitney, along with a number of materials companies and universities. The effort, managed by NASA's Lewis Research Center in Cleveland, is focusing on ceramic composites for the liners in the low-emission combustors, which will have to operate at temperatures approaching 3,000°F. Research on intermetallic composites is also being conducted to reduce the weight of the long, complex nozzles needed for noise reduction.

Although a supersonic aircraft's guidance and navigation requirements are essentially the same as those of a subsonic plane, the doubling of speed compresses events, putting a strain on the crew. This makes it essential for displays and controls to be easily read and activated, and that new levels of flight automation be employed. Even a slight navigation error at Mach 2 could send the plane off course, and the necessary correction would consume considerable amounts of fuel.

A supersonic transport's long, sleek shape makes it difficult for a crew to see the runway during landing. The Concorde solves this problem by mechanically drooping the whole nose of the aircraft. This design adds weight, complexity, and drag. The HSCT will avoid these problems by employing so-called synthetic vision technology now under development. Instead of staring out the window, the crew will look into a computer screen that will display a real-time picture of the outside world.

This computer-generated image will be based on readings from a number of sensors, including video cameras, radar, infrared sensors, and onboard and satellite navigation systems, combined with computer-stored images of the local terrain. By blending these electronic "windows," the synthetic vision system will give the crew a bright, clear, panoramic portrait of the outside world, no matter what the weather.

Computer controls will govern the operation of the noise-reduction systems. Engine noise ceases to matter very much when the plane climbs to its cruising altitude of about 65,000 feet; no one on the ground will be able to hear it. Therefore, any noise-reduction measures that lower efficiency, such as slowing the airflow from the engine, should be implemented only at the lower altitudes. Again, the pilot should not have to think about this; the HSCT needs an automatic control system to adjust the degree of noise cancellation depending on altitude.

Eventually, an HSCT might go even faster than the Mach 2.4 planned for the first generation. But greater speed is not a high priority. An aircraft spends much of its time accelerating to, and decelerating from, its maximum cruise speed. Because of this "overhead," raising the top speed to, say, Mach 4, would not provide a dramatic benefit.

Build It Here

Market studies as well as common sense lead us to predict that most travelers are unlikely to want to pay a fare premium of more than 10 to 20 percent for the privilege of traveling supersonically. In addition, an HSCT will face competition from technologically advanced subsonic aircraft: Boeing, Douglas, and Airbus have introduced subsonic aircraft with lower drag and weight, hence lower fuel consumption, than their earlier models. Such airplanes—plus new advances that we can expect aircraft manufacturers to make by the time an HSCT becomes operational in the early twenty-first century—could push down the cost of subsonic air travel, making it even more difficult for the HSCT to compete.

But subsonic transports are already relatively mature technologies: improvements are more difficult. Supersonic transport technology, by contrast, is embryonic. Thus although the research program is barely under way, and we've just begun to explore some of the problems and potential solutions, the sky (so to speak) is the limit. Success is not assured, of course. But the rapid

pace of early research gives us optimism that once industry begins to apply more of its own talent and resources, we will be able to build an environmentally friendly, economically viable HSCT.

Twenty years ago it made sense to worry that a supersonic airplane would serve only a tiny sliver of the public. But this concern is no longer valid. Long-distance air travel is far more commonplace today. With a potential market of 300,000 passengers daily, someone in the world is going to build a supersonic transport. The demand will be too big to be ignored.

According to market research conducted for NASA, commercial demand could sustain an HSCT starting in about 2005. This would require the aerospace industry to commit itself to developing the aircraft by 1999. The actual timing will depend on when the market, available financing, and—perhaps above all—international agreement on environmental standards converge to create a healthy climate.

Aircraft designers have had a few decades to second-guess the errors of the first-generation SST, realistically evaluate demand and economics, and assess the environmental concerns it poses. With fuller understanding of an HSCT's technological challenges and how to resolve them, the aeronautical community may at last be on the verge of developing a successful high-speed civil transport.

Aeronautics is currently an $80 billion U.S. industry employing close to one million people. It is the largest positive contributor to our trade balance, bringing a net $18 billion. With an economic impact of this magnitude, it is important that the U.S. aircraft industry retain its world leadership. For the sake of the American economy, let's build the high-speed civil transport here.■

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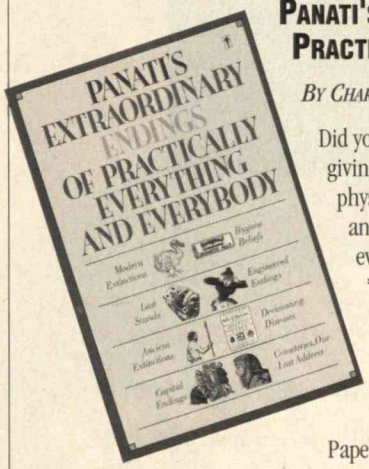
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Engineers hope someday to fabricate "nanoscale" machines, molecule by molecule. But getting there is half the fun.

THE REALLY LITTLE ENGINES THAT MIGHT

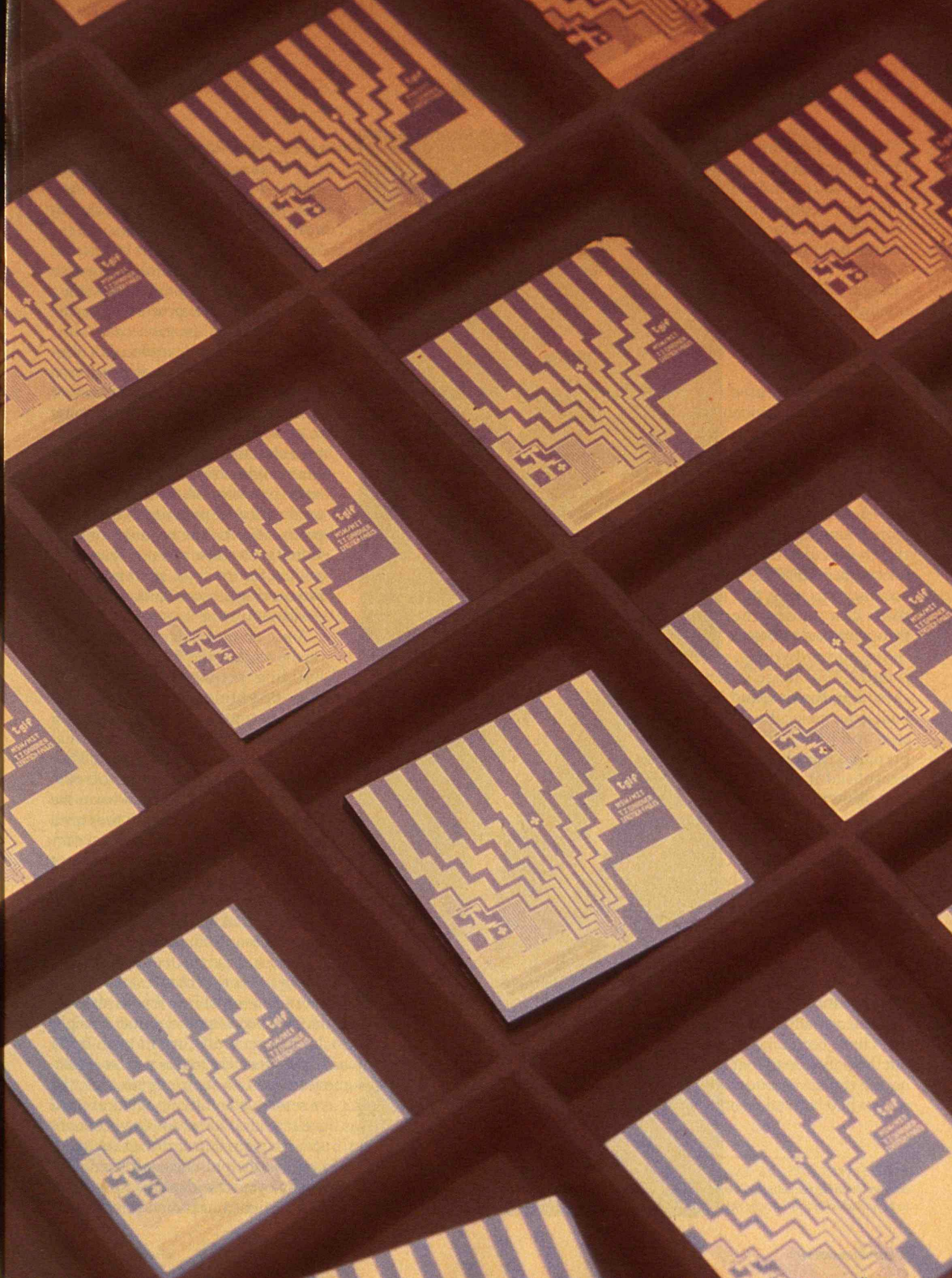


BY FRED HAPGOOD

Gold bands on silicon chips converge into pairs of electrodes separated by a mere 2 microns. Timothy Gardner (above) and colleagues at MIT are trying to build a "molecular voltmeter" by inserting a single molecule into the gap between these pairs.

IN 1959, Nobelist Richard Feynman pointed out that nothing in physics prohibited the design and assembly of parts containing only a few atoms—and that engineering on such small scales could make possible remarkable achievements. For example, with the information represented by a code with elements composed of clusters of a few atoms, every book, magazine, pamphlet, and newspaper ever printed, complete with graphics, could be stored in a volume the size of a credit card. Materials made to atomically precise specifications, with no tiny cracks or impurities, would attain their theoretical limits of hardness, lightness, or strength. Feynman even imagined tiny robotic "surgeons" that would be injected into the body, motor off to a specified site, and conduct the prescribed operation.

PHOTOGRAPHS BY PAULA LERNER



A quarter-century later, engineering theorist K. Eric Drexler, now at Stanford, reexamined Feynman's calculations and concluded that his speculations had if anything been conservative. A microprocessor designer working on the molecular level, Drexler claimed, could put the computing power of the world on a single chip. Medical devices built on the scale of bacteria and viruses, and endowed with artificial intelligence from those tiny computers, could continuously monitor and repair the operation of every cell in the body.

As Drexler pointed out, nature offers persuasive evidence that construction on this scale can be practical and spectacularly versatile. Cells prove that molecular factories can be built; DNA, that huge amounts of information can be stored and read from a single molecule; antibodies, that molecules can recognize and select other molecules to high levels of accuracy; enzymes, that tiny machine tools can guide other molecules through a wide range of transformations; and redwoods, whales, and jungles, that large structures like skyscrapers, ships, and cities can be built from molecules. "Eons of evolution and millennia of history have prepared this challenge and quietly presented it to our generation," Drexler wrote. "The coming years will bring the greatest turning point in the history of life on earth."

At MIT, Timothy Gardner—a graduate student in chemistry and part of a team attempting to take the first tentative steps toward this vision of "nanotechnology"—flips through a photo album on his desk. He shows picture after picture of what look like railways that have been bombed out, blown away, and ripped up. These rails are actually little wider than a bacterium. The pictures have been taken through an electron microscope, but the only clue to that is the quality of the light illuminating the devastation: dim, absorbed, as though the photos had been taken underwater.

GARDNER IS LABORING IN WHAT IS PROBABLY THE MOST DIFFICULT ENVIRONMENT IN THE HISTORY OF ENGINEERING—WHERE ANY OBJECT NOT SECURELY FASTENED TO A SURFACE IS CONTINUOUSLY BEATEN LIKE A LEAF IN A HURRICANE.

Gardner is a member of the Wrighton group (named after its principal researcher, provost Mark Wrighton)—a team with a special interest in the electronic properties of molecules. The group is hoping to study the subject directly, by sticking electrodes into the front and back ends of individual molecules of interest. The researchers might jolt the isolated molecule with a certain voltage, illuminate it with a flash of light, or expose it to a particular chemical. In each case, they would monitor the molecule's electronic response: Does it produce a voltage? Does it become conductive?

If molecular engineering is going to pass from the laboratory into useful technology, molecular electronics is an engineering science that will have to be learned. A molecular voltmeter should provide exquisitely precise data on the behavior of individual molecules, and might serve as a significant tool for engineers attempting to construct nanoscale devices.

Since no molecular voltmeters are on the market, the Wrighton group is building its own. To do this, they must first bring two slivers of metal close enough to be connected by a single molecule, yet not so close that the pieces touch and short out. They must then place the test molecule between these two electrodes in the proper orientation. Finally, they need to confirm that they have accomplished their task. It is a measure of how far we have traveled down the road outlined by Feynman that they can even think of doing such a thing, and a measure of how far we yet have to go that each one of these functions is still on the other side of the state of the art.

Although of near-term interest to help nanoscale engineers build other devices, a molecular voltmeter might itself evolve into a more generally useful tool. If the molecule sandwiched between electrodes responds electronically to some feature of its environment, then the device would act as a sensor. If a molecule of chlorophyll were tied across the electrodes, for example, the circuit could sense minute variations in light intensity. A molecule that responds to the presence of a particular protein—perhaps one associated with a disease—might be tied to a pair of tiny wires and poked through the

FRED HAPGOOD is a science writer based in Boston. This article is adapted from Up the Infinite Corridor: MIT and the Technical Imagination, *to be published in February by Addison-Wesley (© 1993 by Fred Hapgood).*

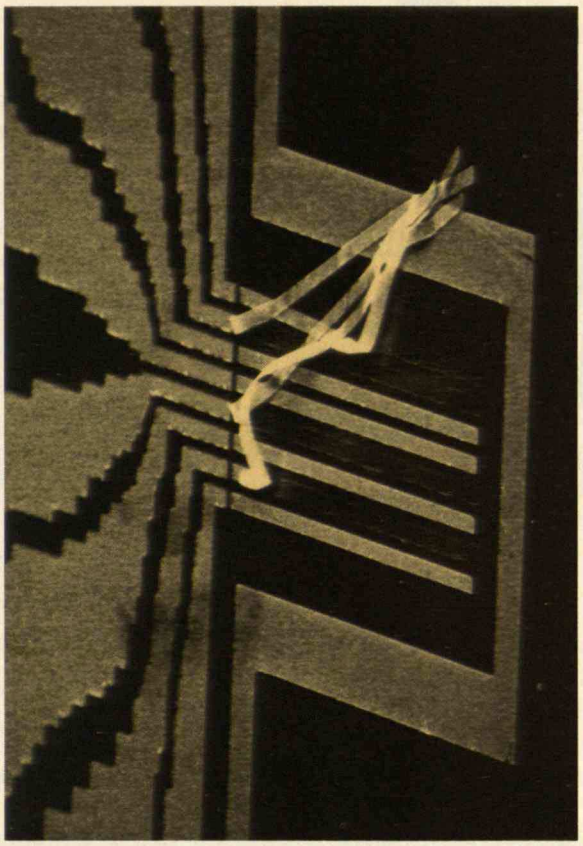
walls of individual cells without even injuring the cell membrane. (Feynman's robot surgeon could use this technology to conduct its diagnoses.)

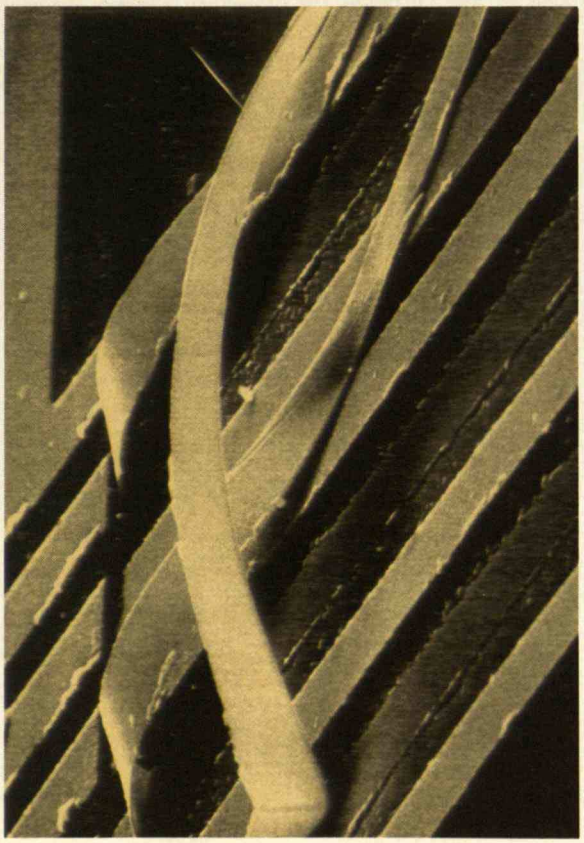
Just as microchips drove down the cost of computing, such extreme miniaturization might eventually yield sensors drastically less expensive than those in use today. Cheap, ubiquitous sensors could continuously monitor our air, drinking water, and beaches for hundreds of pollutants. Doors might unlock at the scent of their masters; a garage smelling too much carbon monoxide in its interior would throw open the windows; and cordon bleu vending machines could concoct recipes by tasting their entrees during preparation. Members of the Wrighton group are helping to lay the groundwork for such applications as they begin to manipulate this heretofore untouched—and untouchable—microcosm.

Tying Things Down

Gardner and his colleagues have to labor in what is probably the most difficult working environment in the history of engineering. A convenient measure of length in this domain is the nanometer, or billionth of a meter, which is to a pebble as a pebble is to the diameter of the planet. Significant changes on this scale occur in a few nanoseconds—and a nanosecond is to a second as a second is to 30 years.

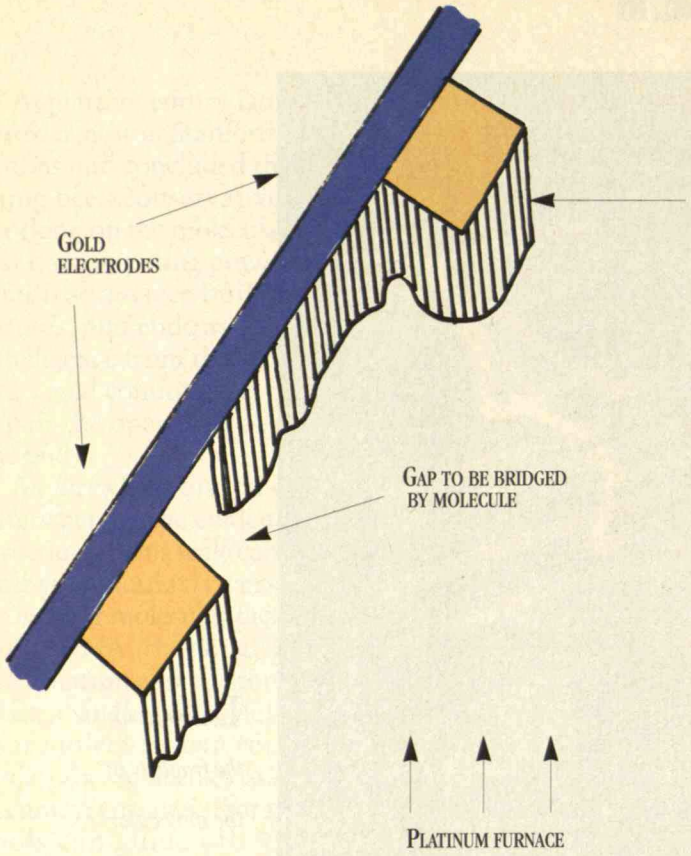
Viewed on the molecular scale, humans move at the pace of geological processes and plow through the landscape with the delicacy of asteroid strikes. Much experience will be required to compensate for such clumsiness—experience being what you actually get instead of what you were hoping for. Over the short run, the most valuable resource to emerge from the team's project may be neither breakthroughs in the science of electronic chemistry nor new molecular sensing devices but rather tactical





Testimony to the fragility of the molecular workspace, these electron-microscope photos reveal the devastation that ensues when Gardner lets a little too much current leak into the electrodes.

PHOTOS: TIMOTHY GARDNER



A spray of platinum atoms closes the 2-micron gap between gold electrodes to as little as 100 nanometers—a distance that the normal growth of hair would cross in 10 seconds. Tilting the chip creates a platinum-free shadow zone behind one electrode that will be bridged by a single molecule.

wisdom—practical hints about the tar pits and dead zones that engineers will encounter when working on the nanoscale level.

No issue better illustrates the difficulties of molecular-scale engineering than the importance of tying things down. In the macroscopic world, forces based on the interaction of masses—friction, gravity, and inertia—give stability to the location and orientation of the items in our lives. Boxes and bricks and stacks of lumber stay where they are put.

On the molecular scale, none of these forces have any practical significance. As objects get smaller, they lose mass by the cube of their dimensional reduction. If buildings had as little mass per unit of height as molecules do, we would be able to toss a 50-story skyscraper into the air with a single breath; a beam of light would knock it tumbling. Any object not securely fastened to a surface or sealed in a solid is continuously beaten, like a leaf in a hurricane, by atoms and molecules bouncing around wildly.

Researchers from a number of disciplines are applying their special knowledge to the possibility of building things molecule by molecule. Electrical engineers are shrinking the features of integrated circuits to a tenth the size of a bacterium; biochemists are introducing ever more ambitious modifications into natural proteins; solid-state physicists are assembling new materials out of novel crystals and molecular clusters; and synthetic chemists are turning skills used to synthesize naturally occurring compounds to fabricate molecules and complex molecular structures unlike any found in nature.

Gardner and the other members of the Wrighton group are moving in from another direction. They are surface chemists—specialists in the interactions of solids with gases and liquids. They are expert at using solutions to transport molecules to known sites, then forcing the molecules to drop out and seal themselves onto the surfaces of a solid. This know-how is critical to building a molecular voltmeter, in which molecules will have to be pulled out of a solution and oriented such that each end bonds to its own electrode.

Closing a Gap

In his quest to build a molecular voltmeter, Gardner starts with an onyx-colored square of silicon about the size of a ladybug. Flat metal ribbons zig-zag away from three of the chip's four edges, narrowing with every sharp turn. The ribbons converge at the fourth edge of the chip, each terminating at a gold electrode separated from its neighbors by slightly less than 2 microns (millionths of a meter). The goal will be to insert a single molecule between each electrode pair, and to read its signal by hooking wires to the larger contacts around the chip perimeter.

Unfortunately, the arts of surface chemistry are nowhere near capable of tying a molecule across a 2-micron gap. The largest circuit-completing molecule that is soluble—and hence that can be easily transported to its precise destination—is only about 5 nanometers (0.005 micron) across. So before they can move on to the next step of building their molecular voltmeter, the

Wrighton group chemists must narrow the 2-micron separation 400-fold.

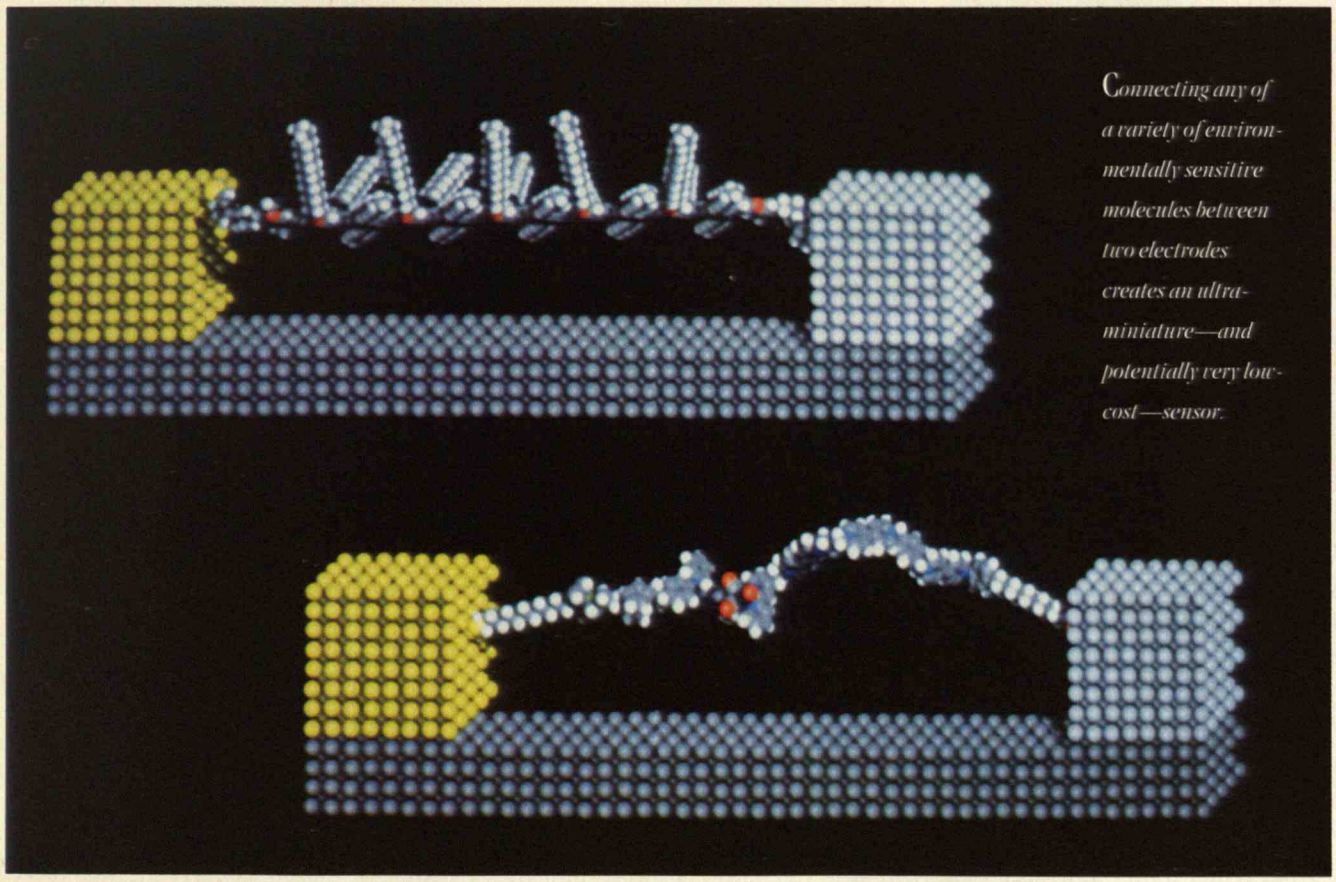
Gardner's method for closing the gap is to lay down a strip of metal atoms that stretches almost—but not quite—from one electrode to the next. To do this, he fastens the chip upside down and at a slight tilt inside a high-vacuum furnace, a desk-size complex bristling with stainless steel tubes, and fires an electron beam at a block of platinum lying under the chip. The beam so excites the platinum atoms that they break off the block and "snow" upward onto the chip. Because the chip is tilted, one electrode shadows its neighbor so that the platinum does not quite completely fill in the gap. Instead, the atoms land in drift-like deposits, piling up against one electrode of each pair and sloping back toward the adjacent one (*see illustration, previous page*).

So far, Gardner has been able to persuade the skirts of platinum atoms to creep to within 100 nanometers of their nearest neighbors. Many viruses could not wedge themselves into a gap this size. The natural growth of hair would cross that distance in 10 seconds. Still, it's not enough: Gardner must somehow narrow the gap by another factor of 20. He has a list of things to try, such as making the electrodes much flatter and more even, thus lowering the risk that an imperfection in the masking shadow will cause a short between neighboring electrodes.

Working with these chips requires excruciating control. Sometimes when Gardner is running an electrical test on these electrodes, the thought of the miraculously diminutive nature of their geometries will distract him for a moment. He is apt to turn a knob a millimeter too far, releasing a trickle too much current into the circuit. Instantly, one of the gold electrodes will overheat, pop off, and pinwheel into the molecular abyss. All Gardner can do is take the chip to the electron microscope and turn it into data of another sort: an image of the devastation that can be imposed on the nanoscale just by thinking about it. And so he fills his photo album with photos of wrecked "train tracks."

Self-Assembly

The molecule that will bridge the ultranarrow channel will be composed of three parts: a segment that recognizes and bonds to the anode (the negative electrode), an electrochemically active segment that does the actual sensing, and a segment that recognizes and bonds only



Connecting any of a variety of environmentally sensitive molecules between two electrodes creates an ultraminiature—and potentially very low-cost—sensor.

PHOTO: TIMOTHY GARDNER

to the cathode (the positive electrode). A beam of high-energy particles will sweep the electrodes clean of molecular debris (mostly hydrocarbons from automobile exhaust), and then the chip will be lowered into a solution containing billions of the tripartite molecules.

The actual connection of molecules to electrodes should by rights be the hardest step of all, since it would seem to demand a high degree of order in a system that is quintessentially chaotic as well as too minute to manipulate. But in the molecular domain, paradoxically, a high level of chaos is the necessary precursor to a high level of order. This last step in the assembly will be conducted by the thermal storm itself, which shuffles molecules though billions of combinations of contacts every second, ensuring that all the anode-loving and cathode-loving parts will find their preferred electrode instantly. (To facilitate this operation, the anode and cathode will be fabricated of slightly different metals.) In nanoseconds, billions of sensors will string themselves in parallel strands across the gap like a self-sewing seam.

Perhaps some day these acts of self-assembly will be so routine and reliable that observation of the process will be unnecessary. But at this preliminary stage, researchers cannot be confident that their molecular device has formed unless they can somehow observe and admire the product—in this case, seeing that the seam really does get sewn.

The team wanted to assess the quality of their sewing in the standard manner—by firing a beam of energy at the site where the molecule might (or might not) be bound to the electrode. Chemicals are identified by tapping them with beam of energy and decoding the signal that bounces back; every chemical species "rings" in its own characteristic way. Unfortunately, the tools ordinarily used in such interrogations are designed for samples the size of peas or marbles. Even the lowest-power beam coming from a conventional spectroscope would rip into a monomolecular structure like a welding torch brought down on a bug.

Thus another member of the Wrighton group, James J. Hickman, rebuilt one of these instruments to express a beam of energy much weaker than the weakest available under the standard settings. Engineers working for the instrument company told Hickman he was wasting his time: with the beam intensity reduced almost to the level of background noise, discerning a signal would be like detecting a whisper in the middle of traffic. But Hickman figured that at this level the sample might survive long enough to radiate a coherent signal back up to the instrument. He just had to figure out how to see it.

The spectroscope reports its findings graphically, in a profile of frequencies representing different materials at different locations. Hickman was looking for evidence that the right molecule had bonded to the correct electrode. By analogy, he was searching for rice grains in a garbage dump in total darkness, using a flashlight that emitted just a handful of photons a second while it destroyed any rice grains it illuminated. With every observation, he recalls, he knew that the sample had been changed, or obliterated.

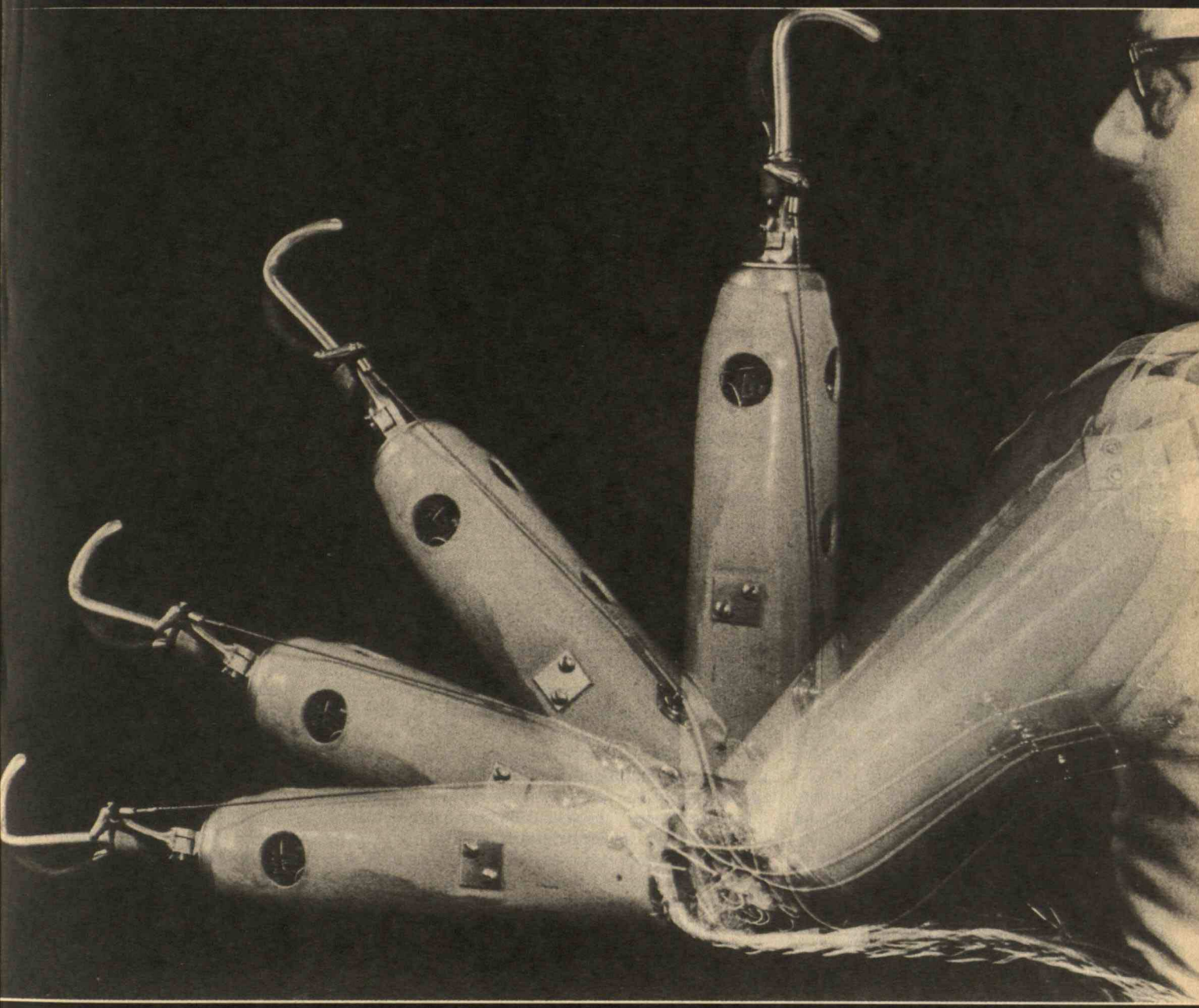
Hickman says he spent "months glued to the machine, tweaking it a little bit, trying to see what had happened, then tweaking it again. I became one with the instrument." He learned how to reprogram the instrument's operating software and change factory-set parameters that few users ever tinker with. He instructed the machine to bypass some of its automated setup procedures, which involved lengthy (and often destructive) illumination of the sample. Instead, he calibrated the system manually, delivering the minimal amount of energy to the fragile sample. Gradually, he grew accustomed to the "darkness," eventually finding evidence that the right molecules had found their way home. He is now doing similar work at Science Applications Inc. in McLean, Va.

VIEWED ON THE MOLECULAR SCALE, HUMANS MOVE AT THE PACE OF GEOLOGICAL PROCESSES AND PLOW THROUGH THE LANDSCAPE WITH THE DELICACY OF ASTEROID STRIKES.

For all the difficulty molecular engineers have in gaining access to their medium, they have at least one tool—their imagination—that can take them down to that domain at any time. One day, as Gardner reviews some of the riddles of self-assembling technology, he stops to muse: "I wonder," he asks, "what the forces are on a molecule falling out of solution? How many g's does it pull?" This is a novel way way of thinking about the domain he is exploring: gravitational forces are not usually counted in molecular mechanics. But they exist, and might somehow be important. Gardner's voice trails off. "What would it feel like to be a molecule?" He sits in silence, picturing the event, feeling his way into the fleet and subtle lives of molecules. ■

MIT

FEBRUARY/MARCH 1993



THE "BOSTON ARM,"
THE FIRST ARTIFICIAL LIMB
DRIVEN BY THE NERVE IMPULSES THAT
WOULD HAVE CONTROLLED THE NATURAL ARM,
OWED MUCH TO THE DESIGN GENIUS
OF MIT'S BOB MANN.

SEE PAGE MIT 7.

MIT
FEBRUARY/MARCH 1993

UNDER THE DOMES 2
Campaigning for credit
Five-year degree for EECS
Directing Athletics: Flippin joins New York development team; Hill steps up to bat

ROBERT MANN 7
Honoring a hands-on career in biomedical engineering

ANN FRIEDLAENDER, 1938–1992 10

CLASSES 11
Jack Sheetz, 1919–1992 17

COURSES 31

DECEASED LIST 46

PUZZLE 47



Cover:
The development of the "Boston Arm" at MIT's Engineering Projects Laboratory in the early 1960s included a collaborator from Massachusetts General Hospital and partial funding from Liberty Mutual. It was a great breakthrough, and everybody wanted a piece of the credit. Since the "MIT/Mass General/Liberty Mutual Arm" was a cumbersome title, the neutral moniker was adopted. Updated versions of the arm are still in production, but Bob Mann, who led the effort, maintains that the pioneering device should rightly be called the MIT Arm.
Photo: MIT Museum

The Political Arena As Classroom

Starting last February, as the presidential candidates feinted and parried and watched the polls, MIT undergraduates took part in a unique class that offered them a window on the maelstrom.

Taught by Charles Stewart III, associate professor of political science , "Presidential Elections" is offered in the spring and fall semesters of election years. The students who signed on were required to campaign for credit: they commited at least 10 hours per week during the primaries or the national election as volunteers for the candidates of their choice. Students also monitored coverage of issues and candidates by different news sources in television, radio, and print. Stewart, who first taught the class 1988, sees it as an opportunity to pry MIT students away from theories, texts, and problem sets for first-hand experience.

"It's easy [for the uninitiated] to imagine that a campaign is about candidates staking out positions and people responding based on those positions," Stewart notes, but campaigns demand more physical than mental exertion. "It's getting people to Harvard Square at seven in the morning to travel to New Hampshire to knock on doors. It's getting people somewhere to hold signs, or make phone calls, or give money at a cocktail party," he says. "It's very much like a military campaign in the sense of marshalling resources and mobilizing people."

Most of the assignments were anything but glamorous. "Last time I was at the office, I emptied the trash," reports Walter Babiec, '94, a Clinton-Gore volunteer. He also did what's known in political parlance as visibility work: holding up signs on heavily traveled roads and passing out pamphlets.

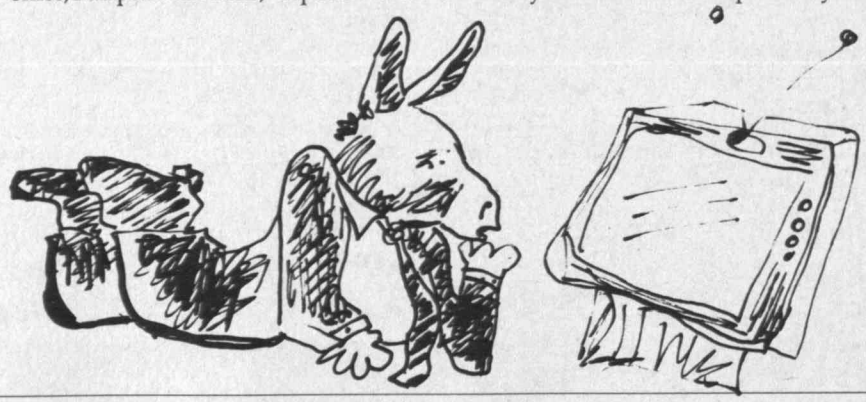
Karen Kaplan, '93, another Clinton-Gore backer, spent hours one day parceling campaign buttons into lots of 50, in the company of a secretary on her lunch hour, a retired man, and another student. "It was such a hodge-podge group," she says, "but it really underscored how broad-based Clinton's support was."

Other students worked the phones, got out a 170,000-piece mailing, made runs to the photocopy shop, signed up volunteers, folded T-shirts, drummed up warm bodies for rallies, and separated trash to keep campaign headquarters environmentally correct.

In 1988, class members were evenly split between Republicans and Democrats. This fall, the pendulum swung toward the Democrats, as 22 students backed Bill Clinton, 4 supported George Bush, and 2 mavericks splintered off to work for Ross Perot. Whatever their political affiliations, the students agree that the Bush volunteers got more plum assignments.

When the campaign staff is smaller, says Stewart, volunteers "are more valued by the people they're working for. They get more interesting things to do and more attention from the paid staff." Indeed, Bush-Quayle volunteer Stacy Robb, '96, joined in meetings and policy discussions, showed the ropes to new volunteers, and helped set up President Bush's campaign swing through Boston. "I'm going to tell them to call me in four years," she says. "It's already rumored that Jack Kemp will run in '96, and I'd love to be part of that."

Many students were surprised by the





chaos of the campaigns. "When we started working for Clinton-Gore in September, they were so disorganized that I wondered if they could pull it off," says Reshma Patel, '93, echoing frustration expressed by other volunteers. "You had to wait an hour and get in line to stuff an envelope."

One aim of the class is peeling back the smooth facade of electoral politics to expose the disorder that doesn't show up on the evening news. "I want students to begin to think about how voters make consistent reasonable judgments following a process that's absolutely loony and chaotic," says Stewart. That question has held his interest for years.

At 34, Stewart is a tail-end babyboomer who registered to vote the day he turned 18. He recalls dallying behind voting booth curtains the first time he voted to run a few tests. "I started fooling around with all the levers to see if I could vote twice, if I could change my vote—what I could do in there."

The same spirit of inquiry fueled his undergraduate career at Emory University. During his junior year, Stewart interned as a liaison between the Georgia legislature and the state campaign-finance commission. Sporting long hair and a beard, he says he encountered a frosty welcome until he was introduced as the kid from Winder, Georgia, hometown to Senator Richard Russell, a powerhouse Southern Democrat from the days when party bosses ruled.

By the time Stewart launched his teaching career at MIT in 1985, he had developed a consuming interest in economic history and congressional politics from Reconstruction to World War II. He created a precursor to the Presidential Elections course that had students scrambling through the 1986 Massachusetts Congressional race, as contenders fought for the seat vacated by the retiring Thomas P. "Tip" O'Neill, longtime congressman and speaker of the House.

Stewart takes a long view on the evolution of electoral politics: voters wooed by sound bites and staged photo opportunities today were equally enthralled by catchy slogans and torchlight parades a century ago. "One of the fascinating developments in this election is how the campaigns, especially the Democrats, got dissatisfied with sound bites geared to the evening news and changed the field of battle to daytime TV, MTV, and the 'Arsenio Hall' show," says Stewart. "Arsenio! Come on! But you can actually talk for more than 20 seconds to Arsenio Hall."

Stewart's students have learned that the action is in the trenches. Danielle Goodman, '95, and Karen Kaplan helped organize the campus, revitalize the MIT College Democratic Club, and get out the vote. Goodman, who put in hours stamping envelopes, holding signs, and doing "a lot of menial work," says she's convinced: "If there weren't people to do these things, the system would never work."□

—Francesca Coltrera

EECS Moves to A 5-Year Degree

Though the motion sounded hardly more than routine, the unanimous faculty vote in December to authorize a new Master of Engineering (MEng) degree has large implications: by 1996, a five-year program leading to the MEng as their first professional degree is expected to be the norm for upwards of 70 percent of all students who enter the Institute's largest department, Electrical Engineering and Computer Science, as undergraduates.

Extending education in engineering to five years has been debated by educators throughout the United States for at least half a century, but this is the first time such a plan has taken root at MIT. EECS will continue to offer an accredited four-year bachelor's program for students who are less oriented to professional engineering careers, want to study for master's degrees elswhere, or fail to qualify for the fifth (graduate) year. However, the five-year MEng will be the mainstream EECS program for undergraduates.

The present research-oriented doctoral programs in electrical engineering and computer science will continue without change. And students who enter MIT for graduate degrees in EECS will pursue traditional Master of Science degrees enroute to doctorates—albeit with the same reduced commitments to theses that characterize the new MEng curriculum.

Voting With Their Feet

Three factors motivated EECS to design a five-year curriculum, Professor Paul L. Penfield, Jr., head of the department, told the faculty:

- An "explosion" of technical knowledge in electrical engineering and computer science since the 1960s has made it increasingly difficult—now virtually impossible—to fit the essential material into a four-year program. The usual procedure, he said, has been to remove or condense the treatment of older topics when new material had to be added. But now, said Penfield, "we don't think we can do this without jeopardizing our coverage of scientific and engineering fundamentals, basic skills, and exposure to current practice."
- The department—indeed, the entire School of Engineering—recognizes the increasing need for engineers to be prepared to deal with non-technical problems, such issues as social responsibility and professional integrity. This was a major emphasis of a Long Range Plan adopted by the School of Engineering in 1989, but so far no department has been able to respond because of the constraints of four-year curricula.
- A majority of recent EECS graduates have gone on to master's degrees, either immediately or within a few years of completing their bachelor's degrees. "They are voting with their feet," Penfield said, "telling us that more than a bachelor's degree is needed." The new program will give students the opportunity to "plan integrated, seamless five-year programs and avoid the inefficiencies that come with hitching together two separate programs."

By "seamless," Penfield means that the fifth year of the new EECS program will "resemble current undergraduate programs more than current master's programs." It will not be research-based, although there will be a thesis, and it will be classroom-oriented. With the new program in place, passing from the senior year to the first graduate year will be more

While the 5-year MEng program promises considerable benefits, it is not the hoped-for "bold departure from existing practices."

like the move from the junior to senior years than the current transition into graduate school.

On the other hand, to enter the fifth year, EECS students will in fact have to be admitted to the Graduate School as capable of completing the MEng degree. About 80 percent are likely to qualify, becoming eligible for graduate housing and financial support. The other 20 percent will take four-year SB degrees.

Gaps to Fill

The five-year curriculum for the MEng degree adds eight subjects not included in the present four-year curriculum: a 24-unit thesis, two advanced subjects in mathematics, four advanced subjects in engineering, and one elective. Already, Penfield told the faculty, the department is at work on a new course in systems, control, communication, and signal processing for third-year students, and (jointly with the Department of Mathematics) on a new subject in second-year math that will be required to support the advanced studies of the fifth year.

But Penfield admitted one frustration: the department, he said, has as yet no plan through which the MEng program will help its students understand the social, economic, and management problems that are inherent in technological change. It's a gap the department knows must be filled but doesn't know how.

After two years of planning and discussion within the EECS faculty, the department's Committee on the First Professional Degree—chaired by Professor Campbell L. Searle, SM '51, with Professors John V. Guttag and William M. Siebert, '46, as vice-chairs—is convinced that the five-year curriculum will result in "a reduction in academic pressure." There will be "significantly greater flexibility" in the curriculum than now, Graduate School admission will be easier for the professional MEng degree than for the research-oriented SM/PhD program, and much of the teaching will be at a slightly slower pace than is possible today.

The new curriculum, with less pressure and better integration of electrical engineering and computer science, means that MEng graduates "will be much better prepared than our current SB graduates to contribute immediately to technology-based industry in a highly competitive world," said the committee report. In addition, these graduates will be better able to "remain indefinitely at the cutting edge of their professional fields."

The five-year program will result in a modest increase—perhaps 10 percent—in graduate enrollment in EECS. The increase in graduate student population due to the MEng program will be partially offset by a decrease in the number of SM students.

The extra tuition income from the added numbers of graduate students will cover the costs to the department, according to Penfield. That includes 3 additional members of the faculty and perhaps 12 new teaching assistants, some of whom will be fifth-year students in the MEng program.

Such appointments will be one of several options that will help students meet the extra costs of one more year at MIT, said Penfield. Enrollment in the VI-A Internship Program will be doubled, giving more students opportunities to earn money in preprofessional jobs under faculty supervision at participating companies. In addition, a number of part-time research assistantships in EECS will be created, and some students will take out loans. MIT will establish a special fund to pay the interest on such loans that comes due before the students complete the MEng degrees.

A "Missed Opportunity" for Change?

Appointment of the EECS Committee on the Fifth Year was one of Penfield's first acts when he succeeded Professor Joel Moses, PhD, '67, as head of the department in 1989. Moses, now dean of engineering, is an enthusiastic supporter of the five-year MEng concept. "The need for the new degree is greater now than ever before," he told the faculty, "because of the growing realization that education through the master's level is required for practicing engineers. Other disciplines that involve professional practice at approximately this level have for years had specially designated master's programs," he said, noting the MIT Master of Architecture (MArch) and Master in City Planning (MCP) programs.

All faculty committees with major responsibility for undergraduate and graduate curricula have approved plans for the new degree, according to Professor J. Kim Vandiver, PhD '75, who chairs the Faculty Policy Committee (FPC). But he told the faculty that his and other committees have two concerns:

- The five-year curriculum proposed by EECS lacks "exposure to such important dimensions of professional practice as social responsibility, professional integrity, communication skills, technological history, managerial principles, and the like."
- In developing the MEng program, MIT is investing significant educational resources to develop a highly structured, professional curriculum. Doing so may make it "more difficult to find time, energy, and resources to alter the existing undergraduate curriculum in other directions," warned Vandiver. "While MEng students from EECS might be highly valued upon graduation, in the longer run they might find their professional aspirations and achievements limited by the relative narrowness of their educational base.

"For the Faculty Policy Committee, the issue is less what the program is than what it is not," Vandiver wrote. "We wish it were a bolder departure from existing practices." FPC endorses the MEng degree because its benefits promise to be significant, said Vandiver, but the committee asked for a commitment, now written into the faculty motion, for "a general review of all MEng programs after five years." That review, Vandiver said, should look into several areas of concern: funding, including effects on both students and MIT; admissions criteria; changes in freshman admissions patterns; and effects on undergraduate pace and pressure. Most important, he said, the review should allow all concerned to "assess the overall direction of the MEng program in relation to other educational choices." □

—John Mattill

PHOTOS: MIT NEWS OFFICE

Flippin Embarks on New Career in Fundraising



Royce Flippin, Jr., MIT director of athletics for the past 12 years and a national name in sports since his All-America football days at Princeton University, has moved into a new post as a director in MIT's New York City development Office.

Flippin, who is the former president of the 265-member Eastern College Athletic Conference, said his decision to step down as MIT athletic director was a difficult one. But he and his wife had decided that it was the right time for them to move closer to their family in New Jersey.

"Royce's tenure has been extremely productive—in programs, in facilities, in quality of staff, and most of all in the extraordinary range of athletic opportunities and achievements of MIT students," said Vice-President Constantine Simonides, '57, who hired Flippin in 1980. "We will miss his leadership in the Department of Athletics, but we are very happy he will remain with MIT in New York."

Simonides and Flippin both paid tribute to the MIT staff and the unique program, noting that approximately 20 percent of all undergraduates compete in at least one of MIT's 39 varsity sports. In the last two years alone: six MIT students have received prestigious NCAA postgraduate scholarships (the highest total of any college or university in the country over that period); MIT football players have twice won the Woody Hayes Award as the outstanding scholar-athlete-community leader in the nation; and 28 students have been named to All-America status, also a record performance.

In his new post, Flippin will have responsibilities for major gifts prospects, athletics facilities, and other student-related fund-raising , according to Vice-President and Treasurer Glenn Strehle, '61. Working out of MIT's New York office and living in New Brunswick, N.J., Flippin also expects to do some independent consulting in business and human development.

Flippin came to MIT in 1980 following a year with MBA Resources, an executive training firm with offices in New York and



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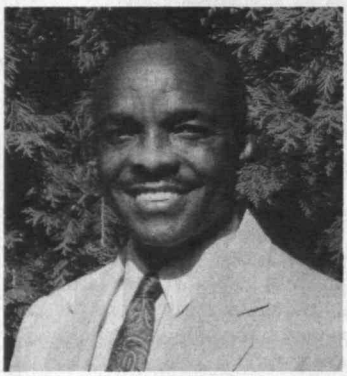
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Chicago. Prior to that, he was for almost seven years director of athletics at Princeton, where he had racked up an outstanding record as an undergraduate football and baseball player.□



Richard Hill Named Director of Athletics

Richard A. Hill, senior associate director of athletics at the University of Louisville and former track coach of Edwin Moses, Bob Hayes, Willie Davenport, and other world-record holders, was named last August to succeed Royce Flippin as director of athletics at MIT.

Hill, 55, was responsible for the day-to-day operation of the Athletic Department and supervised 19 men's and women's varsity sports programs and support services at Louisville. Prior to that, from 1981 to 1986, he was director of athletics and professor of physical education at Southern University in Louisiana; and he was head coach of men's cross-country and track for nine years at San Diego State University, where he was named NCAA District 7 Coach of the Year in 1981. Over the years, his student athletes won five national championships and have tied or broken more than 30 world records.

"We knew that Royce Flippin would be difficult to replace," said Thomas J. Allen, PhD '66, who headed the advisory committee on the selection of the new director. "But we were very fortunate to identify such an outstanding successor." Allen is the Gordon Y Billard Fund Professor of Management and chair of the MIT Athletic Board.

Flippin, MIT's athletic director for the past 12 years and now a director in MIT's New York City development office, said he is looking forward to working with Hill to raise money to support athletic programs. "Dick Hill's enthusiasm for and understanding of sports is reflected in his own high school and college record as a star in basketball, football, track, baseball, and golf, and through his training and teaching experience in anaerobics and movement," Flippin commented.

Of course, Hill has a lot of good material to work with. Since 1980, MIT coaches have received national or regional honors in 12 sports, and 127 students in 16 different sports have received All-America honors. "MIT's sports program enjoys a national reputation for its scholar-athletes, its unique scope and quality, and the broad participation by two-thirds of the university's 10,000 undergraduate and graduate students [in intramural or varsity sports]," Hill said. "It is an athletic director's dream to be associated with such a program."

Born and raised in Yonkers, N.Y., Hill graduated in 1960 from Southern University in Baton Rouge with a BS in physical education. He was the first student from a predominantly black college to earn a National Association of Intercollegiate Athletics (NAIA) Scholar-Athlete Graduate Scholarship,which supported his pursuit of a master's degree in education from the University of Buffalo in 1962. In that same year, he won the Western New York State decathlon championship, and he also was a member of the New York AAU national basketball team for two years.

As head track coach at Florida A&M University from 1962 to 1964, Hill coached 1964 Olympic 100-meter champion Bob Hayes, "the world's fastest human," and guided the team to conference championships in 1963 and 1964. From 1965–69, and in 1971–72, he was Southern University's head track coach, leading them to five straight NAIA track championships. He was named NAIA Coach of the Year in 1965, and Southern was honored by *Track and Field News* as having the nation's best collegiate track program in the decade of the 1960s.

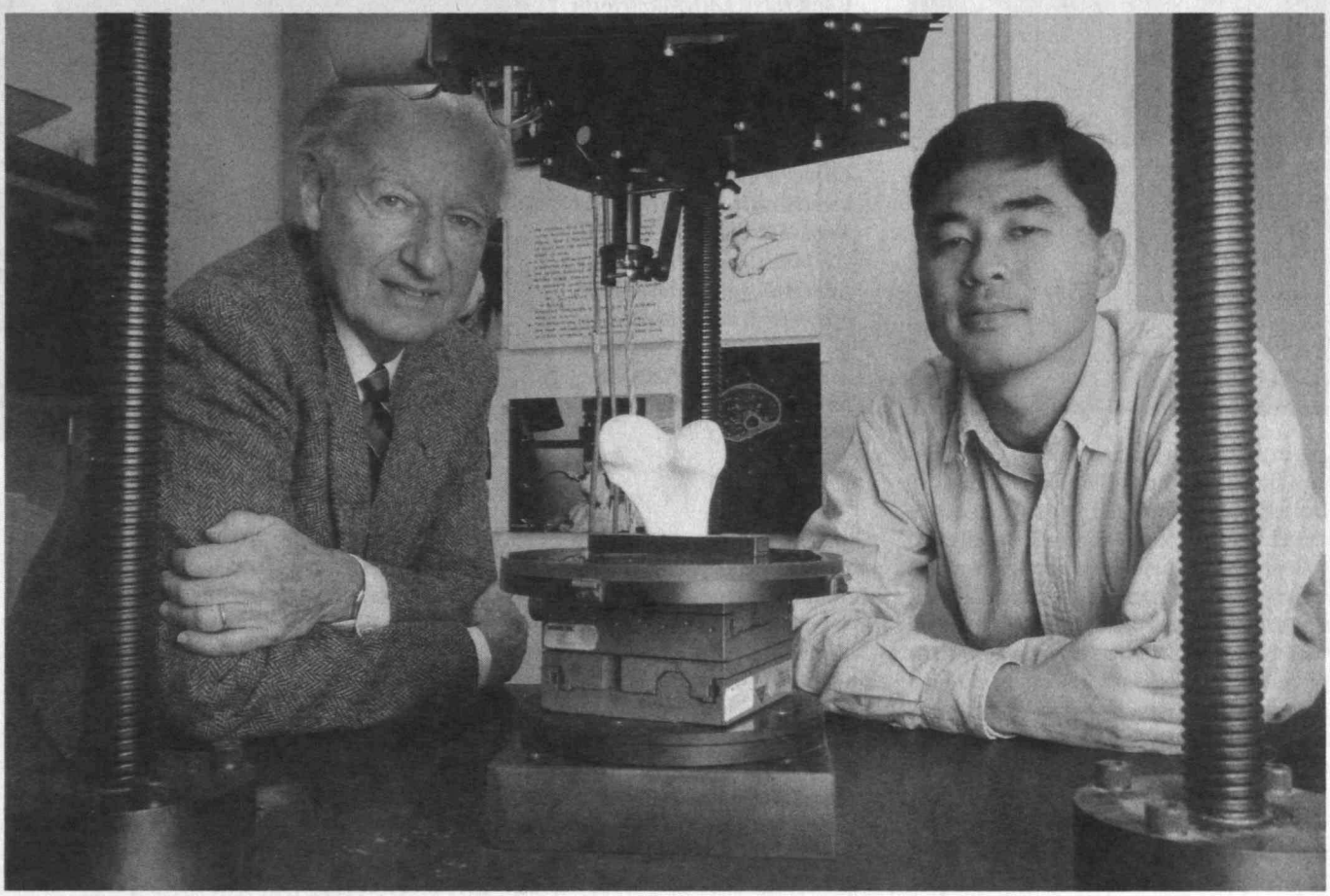
Hill received a doctorate in exercise physiology in 1970 at the State University of New York at Buffalo.□

—Roger Crosley (The author is director of sports information at MIT.)

By David W. Andrews, '66

Robert Mann, '50

A DESIGNER'S DESIGNER



Keita Ito, '85, who did bachelor's and master's theses with Mann and is working on a PhD as well, is shown here with Bob and a device that simulates the action of the human hip joint. Ito, who is also pursuing an MD at the Harvard Medical School, is studying methods to repair cartilage and bone.

The symposium that drew his colleagues, collaborators, and former students to campus seemed designed to create difficulties for Bob Mann. First, he had to spend an entire day with a group of people who, on most counts, actually agreed with him. Then, to compound the frustration, he had to sit and *listen*. Only at the end of the day did he have an opportunity to rise and speak, discovering that "almost everything I wanted to say has already been said." Such were the rigors of impending retirement.

Inventor, educator, and mentor, Robert W. Mann, '50, SM '51, ScD '57, Whitaker Professor Emeritus of Biomedical Engineering, officially retired as of July 1992 (although no one who knows his work habits would be surprised by his recent comment that "my post-retirement schedule is much like pre-retirement, I just don't get paid"). The shape of engineering education at the Institute and biomedical engineering design in particular have been indelibly marked by his 42-year career.

Mann's view of his work is clear-eyed and direct: "Engineering design is the center of gravity—the only raison d'être for an engineer," he has said. "If you can't design it, you can't manufacture it."

"Bob Mann championed the open-ended design project as an educational device," said Herbert Richardson, '53, SM '55, ScD '58, now chancellor of Texas A&M University, who was on hand for the symposium. "The early introduction of design projects teaches teamwork, and, most importantly, that you can't wait until you know everything to do the project."

The importance of that approach was reiterated in remarks by Mann protégé Stephen Jacobsen, PhD '73, director of the Center for Engineering Design at the University of Utah and a designer of robots for Disney. "You can spend time talking about design but never finish," Jacobsen said. "It's better if you don't talk but finish stuff. Some things are better done than said."

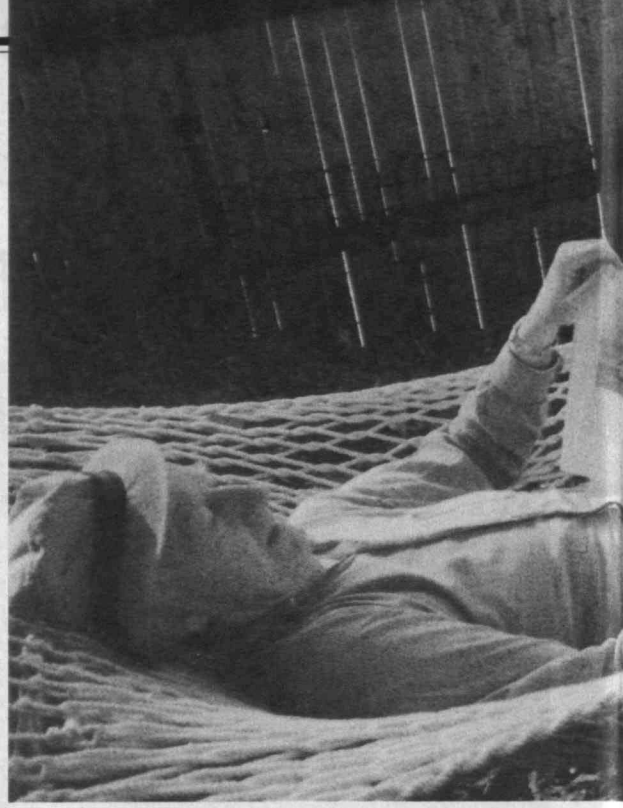
These views are not universally supported. The engineering education community is split on the issue of how to educate peo-

PHOTO: J.D. SLOAN





A symposium marking Mann's retirement brought dozens of his former students and collaborators to Cambridge. Left: Mann with Guy Stever (left), a former head of the MIT Mechanical Engineering Department who went on to preside as president over the merger of Carnegie and Mellon Universities. Below, r. to l.: John Kern, '50, Sherman Grinnell, '52, James Reswick, '43, and John Hrones, '34, posed with Mann for a mini-reunion of members of MIT's Dynamic Analysis Control Laboratory, which operated during the 1950s and 1960s.



ple in the design process. The two extremes can be characterized as the "learn-by-doing" group versus the proponents of "teach them science—the design skills will follow when industry gets hold of them." A third position is that design itself is a science, but no one has yet done enough research to uncover the laws that govern its operation. Mann, however, is convinced that design will never be reduced to a number of algorithms. "While a firm basis in science is vital," he says, "all design is multidisciplinary, and design knowledge is experientially based."

Symposium participants such as John Hrones, '34, SM '36, ScD '42, professor emeritus at Case Institute of Technology (now part of Case Western Reserve University), shed some light on how the existing state of engineering design came to be. "I came to MIT in the early '30s," Hrones recounted, "when the Mechanical Engineering Department was concerned with textiles and leather, the manufacture of cloth and shoes. During the late 1930s and early '40s, interdisciplinary labs developed—the first part of the war effort. We all got the novel experience of a greatly accelerated product cycle, from design to testing to manufacture."

"During the war," Texas A & M's Richardson said, "we discovered that engineers had been *trained* rather than educated. It was hard for them to bring together new technologies. Because of this problem, scientists were converted into engineers. Scientists provided leadership." After the war ended, this pattern developed into a direction for education, with a new emphasis on the scientific basis of engineering.

"This new wave washed out some good along with things that needed changing," Richardson continued. "Analysis replaced synthesis. Theory replaced hardware."

Design Education Starts Early

An engineer who lists his eighth-grade shop teacher as an important mentor, Mann had always maintained his strong manual and machine-design skills. "Nowadays, the message conveyed is both subtle and overt: working with your hands is somehow not as 'good' as intellectual pursuits," he says. "But because of my experiences, I like to involve students as the responsible practitioners in design projects."

This is exactly what Mann and his colleagues proceeded to do at the Dynamic Analysis and Control Laboratory in the 1960s. They oriented their teaching to encompass "system dynamics and control," which provided a framework for control of complex interacting components, and "engineering design," which supported the creation of new systems.

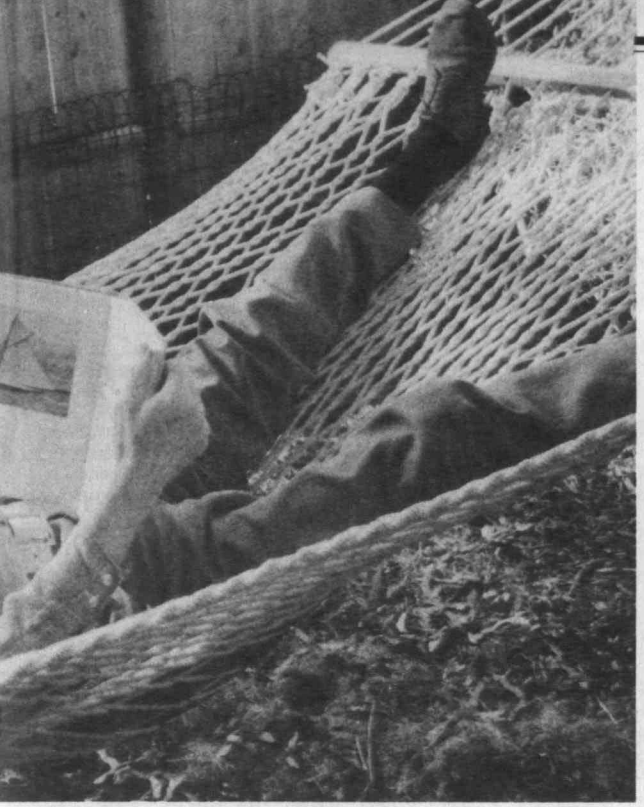
It was in developing designs to address unprecedented engineering problems involving *living* systems that Mann would find his life-long challenge and his greatest satisfaction. He credits his pathbreaking work in biomedical engineering design to two fortuitous occurrences: his meeting with John Kenneth Dupress, a soldier who had lost his eyesight during the Battle of the Bulge, and Norbert Wiener's accident. "Dupress influenced me to try engineering solutions to rehabilitation problems," Mann noted, "and Norbert Wiener broke his hip." That fracture "forced us to examine how the idea of cybernetics related to artificial limbs" and led to the development of the Boston Arm, the first prosthesis controlled by brain signals to the muscles that would have controlled the amputated limb.

In an interview with MIT editor Theresa Pease, Mann described his method. "I'm an engineer: the way we think, a bone is a link; a joint is a bearing; a muscle is an actuator; ligaments and tissues are springs that resist the movement passively." But applying engineering principles to living bodies makes for exceedingly difficult design.

"In biomedical engineering," explains Hrones, "the systems we wish to imitate already exist in forms that are virtually impossible to duplicate. We know the performance expected, but each device is unique. And what about the interface between the brain and the device? It's very complex!"

James Reswick, '43, SM '48, ScD '54, of the National Institute on Disabilities and

PHOTOS: ELIZABETH HAMLIN; MIT MUSEUM





Left: Inspired by planners of Mann's retirement symposium, who set up a design project to solve HEEP—the Hammock Entry and Exit Problem—members of Mann's Newman Laboratory for Biomechanics and Human Rehabilitation couldn't resist presenting their long-time leader with a hammock, for research purposes only. Right: Woodie Flowers (left) now one of the most revered teachers at MIT, did his doctoral thesis with Mann in 1973 on an early version of the MIT Knee.

Rehabilitation Research, directs a facility whose mission is applying the lessons that Bob Mann teaches. He notes that much progress has been made in designing prostheses that are controlled by the electrical impulses from nerves in the stump, but there is still a lack of feedback telling the user where a robot limb is positioned and what it is doing. "You can move your arm to within half an inch of where you want it with your eyes closed," Reswick said, as he touched his nose with an outstretched finger. "That's very hard for someone to do with an attached limb. It's the next frontier for biomedical engineering."

Reswick's attitude toward the challenges of his field are reflected in the logo he has designed for NIDRR: two hands jointly repairing the Egyptian hieroglyph for "health." "Note that one hand, that of the surgeon, has long, graceful fingers," he pointed out, "while the other hand has the stubby fingers of the engineer. They're both holding the symbol together, while the glue sets."

Graceful Exits

No tribute to Bob Mann would have been adequate without a hands-on component, still less if it lacked humor. And so symposium organizers challenged a surprised panel of Mann's past and present students—who expected to be offering their opinions on design education—to find a solution to HEEP, the Hammock Entry and Exit Problem. HEEP was explained as "an affliction of newly retired academics unaccustomed to the rigors of relaxation."

The specifications were clear. People have little problem with lying in a hammock; it's getting in and out of the device that leads to untimely and ungraceful applications of the law of gravity. The problem stems from the near impossibility of choosing correct "hammock installation parameter values." So the participants were charged to design a "product that will provide the hammock experience while eliminating the risk of HEEP." Panelists were warned that since " the culture of this market generally predates the computer, 'virtual hammocks' are unlikely to be a big hit."

A number of amusing and possibly even practical solutions were proposed. A top contender was the one described as "the cheapest way to do anything: use students and post-docs." So a group drawn from this cheap labor reservoir held Bob aloft in a blanket, gently rocking him to and fro. Never one to discourage creativity, he muttered, "It's great!"

Being the "victim" of the spoof was a small price to pay for the exhilaration of having so many of his present and former students in the room at the same time.

"Two of my students," Mann notes with obvious pride, "have become department heads here (David Wormley, '62, SM '64, PhD '68, and Herbert Richardson), and I've trained more than 40 students who are faculty members at other schools worldwide." At MIT, Mann's opened-ended design projects evolved into that MIT icon, the 2.70 Design Contest created by Woodie Flowers, SM '68, ME '71, PhD '73. Now Harry West, SM '84, PhD '86, not only runs 2.70 but has taken proselytizing for hands-on design to the next level with his International Design Competition. *(See page 18 in Trends for more on design competitions.)*

"Bob certainly had a lot of influence on the process of change in design education," Flowers says. "He has been an eloquent spokesman for the need to directly involve students in tackling design projects. We both felt strongly about the need for *realism* in design education." The potential for creativity is broadly distributed, Mann has often said, and it is the job of education to provide the opportunity for its expression.

With Mann's official retirement, could one say the torch has been passed? "I like to think there are lots of torches," says Flowers. "and Bob certainly lit many of them." □

DAVID ANDREWS is a freelance writer and a chemist at Repligen Corp. in Needham, Mass.

1938-1992

ANN FRIEDLAENDER

Leading with Style and Passion

Ann Fetter Friedlaender, PhD '64, the first woman to serve as dean of a school at MIT, died on October 19 after fighting cancer for several years. Friedlaender, only 54 years old and an active faculty member at the time of her death, had served as dean of the School of Humanities and Social Science (SHSS) from 1984 to 1990.

"She elevated the stature of the humanities at MIT, believing that her job as dean should be to place them in a central position of importance and respect," says Philip Khoury, her colleague and successor as head of SHSS. "That was one of her great successes."

The campus felt Friedlaender's loss all the more intensely because it has been little more than a year since another of MIT's path-breaking female academic administrators—Margaret L.A. MacVicar, '65, dean for undergraduate education—had succumbed to cancer in her prime.



In the heavily male MIT environment, the achievements of women stand out in stark relief. So it was when Friedlaender, as chair of the Economics Department in 1983 and '84, became the first woman to head an MIT academic department. She quickly moved up to dean, and when she retired from that post to return to teaching and research, she was described by Professor John M. Deutch, '61, then provost, as "one of the best deans to have graced MIT in its history."

A strong presence, yet unassuming, Friedlaender was passionate about promoting ideas, not herself. "She had a remarkable style, which was evident when she ran meetings," says Peter Diamond, PhD '63, professor of economics. "She wasn't bullying anybody, but she was running the show. She would focus on business, without personal considerations getting in the way. The flip side was that business never got in the way of personal relations.

"She treated people as individuals with respect, but without hesitating to call somebody's idea 'wacko,'" Diamond recalls. "Wacko is in fact a term she used. But it wasn't a term that referred to the person, it only referred to the idea or proposal. She had the ability to find a middle ground, where she was simultaneously dean and friend. In fact, there was a sense of balance about her that was wonderful. A lot of people really loved her."

Her involvement in a reassessment of the undergraduate program through the mid- and late 1980s contributed to curriculum changes that strengthened the arts at MIT and brought the School of Humanities and Social Science closer to other schools. As dean, she sponsored the successful Burchard Scholars Program, which provides opportunities for intellectual exchange and promotes a sense of community among undergraduates who excel in the humanities, arts, and social science.

Her enormous energy was coupled with "a real sense of how to establish priorities and how to sort through academic politics, knowing when to hold and when to fold," says Barbara Stowe, MIT's director of foundation relations and development services. "Extremely warm and generous, she had the unusual ability to be very forceful with civility and humor."

"I remember her laugh," says Pauline Maier, William R. Kenan Jr. Professor of American History. "It wasn't hearty, it was just a kind of chuckle, as if she appreciated the comedy in ordinary human relations."

Holding appointments in two MIT departments as the Class of 1941 Professor of Civil Engineering and Economics, Friedlaender was an authority on the economics of transportation and public-sector investments in infrastructure. In eight major books and monographs, she examined economic issues surrounding the construction of the U.S. interstate highway system and the equity and efficiency issues in the railway and trucking freight industries. Friedlaender was not only recognized as a pioneer in building econometric models of the transport sector, but as a longtime director of Conrail she also applied her insights to practical problems of rail-freight transportation.

Despite her scholarly and administrative responsibilities, she "saw to it she was home for supper. Her family life with her husband and two sons was important to her, and she protected it successfully," says Maier. Friedlaender also found time to enjoy bicycle touring, golf, tennis, skiing, and the Red Sox. A cycling companion, Douglas Pfeiffer, assistant dean of SHSS, says, "she enjoyed the simple things in life. Bike riding symbolizes that for me. She was an athlete, with a positive attitude. Never remote, she was always unpretentious."

A native of Philadelphia, Friedlaender received a BA in economics from Radcliffe College in 1960. After receiving the doctorate at MIT, she was a Fulbright lecturer in 1964–65 at Svenska Handelshogskolan in Helsinki, Finland. Between 1965 and 1974 she was lecturer, assistant professor, and professor in the Department of Economics at Boston College. Her MIT career began with a year as a visiting professor in the Department of Economics in 1972–73, followed by appointment as professor of economics and civil engineering in 1974.

Nobel Prize-winning economist and Institute Professor Robert Solow remembers his colleague as "both self-possessed and enthusiastic. She was always in command of herself, but when she liked something—an idea, a person, a course—she expressed an all-out camper spirit. Nan always knew where she was and what she

(Continued on page MIT 23.)

CLASS NOTES

16

We are pleased to report this news on **Dick Knowland**, our first opportunity to record such a noteworthy accomplishment: "Richard Knowland of Sunshine Manors in Clearwater celebrated his 100th birthday at a party with friends and with his family. Knowland was born September 20, 1892, in



Norway, Maine. . . . He served as a captain in the chemical warfare service during World War I. He also was a VP in charge of manufacturing for Bigelow Sanford Carpet Co. and a consulting engineer for several other companies. He was married to Katherine G. Knowland for almost 70 years before her death in 1989. His 91-year-old sister from Newburyport, Mass., and his two living sons joined in his birthday celebration. He has seven grandchildren and five great-grandchildren." Congratulations, Dick, on being our first "Sixteen" to hit the century mark. Write to us when you can. Our thanks to Dick Knight, '47, for sending us this wonderful news item.—**Bob O'Brien**, acting secretary, 25 Keith Rd., Pocasset, MA 02559

17

Please send news for this column to: **Don Severance**, acting secretary, 39 Hampshire Rd., Wellesley, MA 02181

18

On Sunday, October 18, the Cardinal and Gray Society had its meeting at Endicott House in Dedham. As you may recall, this group was started by our class so that graduates out 50 years or more could share our common interests in MIT, particularly as time makes inroads in our individual classes. We had a group of more than 50 graduates and their better halves who shared their devotion to their alma mater.

We were fortunate to have as our speaker of the day, Professor Irwin Sizer, whom I have known these many years. He told us in a most interesting fashion of the development of the MIT Department of Biology, which he once headed. It now serves over 5,000 MIT students who annually participate in these classes. He also told us of the many developments in this field that benefit all of us.

I was the only representative of the class of 1918 present. **Eli Berman** had expected to be present but had a fall at home that resulted in his being at the Spaulding Rehabilitation Center with bruises, but no broken bones. He expects to be home in about two weeks.—**Max Seltzer**, secretary, 865 Central Ave., Needham, MA 02192

19

The Alumni/ae Office sent us an updated list of living classmates. To my surprise, there were 50 listed. At this date, it still seems a substantial class. However, before the ink was dry, we were advised by the same source of the passing of Professor **Wayland S. Bailey**. He died on September 4, 1992, in the Quincy Hospital after a long illness. His home address was 223 River St., Box 213, Norwell, Mass. He was an instructor in mechanical engineering at Lehigh, Connecticut, Northeastern, MIT, and Norwich Universities. In 1957, he started his second career in engineering with Bethlehem Steel and A.D. Little & Co. and worked until he was past 80 years old. He was the husband of the late Jessie I. (Randell) Bailey. He is survived by a son, a daughter, eight grandchildren, and eight great-grandchildren.

A great credit to our class, we have enjoyed our association with this talented and energetic son of MIT. Sincerely, we are impressed.—**W.O. Langille**, secretary, P.O. Box 144, Gladstone, NJ 07934

20

Please send news for this column to: **Harold Bugbee**, secretary, 313 Country Club Heights, Woburn, MA 01801

21

Very little news this month, and that personal. Your secretary has had a bout of shingles. Back as a teenager he also had a bout of shingles. Most people report that it's painful, but I'm fortunate. I'd classify them as just uncomfortable.—**Sumner Hayward**, secretary/treasurer, Wellspring House E64, Washington Ave., Ext., Albany, NY 12203; **Samuel Lunden**, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

22

Our class will be interested in a letter I received from Prof. Barton Zweiback, who now holds the 1922 Career Development Professorship. He writes, "This award represents strong support for the research I do here at MIT. My work has concentrated in trying to properly formulate the equations that describe string theory. String theory is a fascinating new development in theoretical particle physics. I wish to let the class know my heartfelt appreciation of the award, and also wish to extend my thanks to all the members of the Class of 1922 for their generous gift which represents very significant support at this stage of my career."

Your secretary informs you with sorrow of the death of our classmate, **Harvey E. Brown**, on September 17, 1992. Harvey graduated with bachelor's and master's degrees in engineering. He had been a chemical engineer with the New Jersey Zinc Co. in New York City for 35 years before retiring 27 years ago. He had lived in Montclair, N.J., for many years, and was the proud grandfather of two.—**Martha E. Munzer**, secretary, 4411 Tradewinds Ave., E., Lauderdale-by-the-Sea, FL 33308

23 70th Reunion

Please send news for this column to: **Fred Almquist**, secretary, 19 Griswold Rd., Wethersfield, CT 06109

24

A letter from **Albert S. Anderson** to Col. **Henry Stearn** was passed on to me. It is dated September 10, 1992 from Anderson, S.C.: "My wife, Lila, and I celebrated our golden wedding anniversary on Labor Day. I framed the letter of congratulations from our son and his family. I hung it on a wall of my bedroom under a framed picture of the 50th Reunion of the class of '24." Thank you for writing, Albert. It is good to hear from the classmates. I wish I had more such correspondence to fill this column.

The Alumni/ae Association reports that **James I. Metcalf** passed away August 11, 1992. His widow, Veida, provided the information about his life and says, "He was a multi-faceted man. He had a fine mind." After receiving a degree from MIT, James worked for several Eastern electric utilities and telephone companies. He was involved in development of the St. Lawrence Seaway and co-author of a government report that helped establish the Tennessee Valley Authority, which dammed and developed rivers in the Southeast. In the late 1930s, he went to the Northwest to head marketing efforts for the fledgling Bonneville Power Administration, charged with selling electricity from federal dams on the Columbia River. "Everyone thought it was a boondoggle of the first order," Veida recalls. "They had all this abundance of power. What were they going to do with it?" The BPA now provides about half the region's electricity.

James left Bonneville to go into consulting and he and a partner helped promote formation of the Northwest Public Power Association. They did much of the engineering and financial research for the public-utility districts that were forming in those years.

He joined the Navy during World War II, working in intelligence in the South Pacific. He survived nine amphibious landings and served at Saipan, Iwo Jima, and Okinawa. After the war, James joined Harza Engineering of Chicago, helping to develop hydroelectric power projects in El Salvador, among other places. But he tired of travel and opened his own hydropower and water-supply consulting business in Seattle.

After retiring, he developed property on Hoimes Harbor on Whidbey Island and worked with his wife, Veida, to develop her family land in Seattle. He helped preserve Goldmeyer Hot Springs property held for decades by Veida's family, by donating these 28 acres of land to the Northwest Wilder-

ness Programs, a nonprofit membership organization that James co-founded. "It's one of the most beautiful spots in the country," Veida says, "and our intention was to keep the forest and waterfalls in their natural state."

James Metcalf is survived by his wife and a daughter, a sister and two grandsons. The family suggests remembrances could go to Northwest Wilderness Programs, 202 N. 85th St., Seattle, WA 98103.

Our condolences to Mrs. Metcalf and all the family. Co-secretaries: **Katty Hereford**, Box 5297, Carmel, CA 93921; Col. **I. Henry Stern**, 2840 S. Ocean, #514, Palm Beach, FL 33480

25

With the listings provided annually by alumni/ae headquarters, I have been able to bring my file up to date. As of November 1, 1992, addresses are available for 103 classmates. Unfortunately, there are more than 70 listed for whom no address is available. There have been only three major moves during the past year. **Charles M. Billman** left Fort Myers, Fla., and is now located at 1300 S. Harrison St., Amarillo, Tex. **Walter J. Rhodes** has moved from New London, N.H., to 211 Fairground Rd., Lewisburg, Pa. **Harry E. Thomas** has left Columbia, S.C., and now resides at 275 Merriweather Rd., Grosse Point, Mich.

Eight classmates are living outside of the U.S. It would be nice to hear from them. Their names and locations follow: Prof. **Wen Y. Cheng**, Shanghai, China; **Theodore S. Durrant**, London, England; **Joseph E. Gossens**, Brussels, Belgium; **Tsung Shu Hsu**, Taipei, Taiwan; Prof. **Shi Jilyang**, Beijing, China; **Savo P. Orahovatz**, Sofia, Bulgaria; **John E. Sutcliffe**, San Jose, Costa Rica; **Raymond P. Trevil**, Montreal, Canada.—**F. Leroy "Doc" Foster**, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

26

By the time you receive this, fall will have long passed by. It was such a beautiful one in this part of the country that just enjoying the colors is worth mentioning.

Not much other positive news. We do have two deaths to report. . . . **Richard A. Butler** died August 10, 1992. He had lived in the Plantation, Fla., area. A graduate of the School of Architecture, he is survived by his wife, Alice, a son, daughter-in-law, four grandchildren, and eight great-grandchildren.

Roger R. Smith of Heritage Heights, N.H., formerly of Gardner, Mass., died September 10, 1992. He was president and owner of the former L.B. Ramsdell Co. in Gardner. He served as a director of the Gardner Savings Bank and the former First National Bank of Gardner, and was on both the Gardner School Board and the investment board of Lumber Mutual Insurance Co. of Boston. He began a new career in Jaffrey, N.H., as a land surveyor. He also served as town auditor and was a trustee of trust funds. He was a member and trustee of the First Church of Jaffrey and the Village Improvement Society. He leaves his wife of 66 years, Florence, two sons, a daughter, eleven grandchildren, and seven great-grandchildren.

That's all folks. Please send some positive news.—**Donald S. Cunningham**, secretary, Eventide, 215 Adams St., Quincy, MA 02169, (617) 328-1840

27

From telephoning a few classmates, I have a few comments. Harriet and **Carlton Davies** in Charleston, S.C., are in reasonably good health but Carl's right ankle has weakened to the point that he has to use a crutch and cannot drive his car. He enjoys lunches once in a while at his Yacht Club where he is No. 2 in seniority.

I'm sorry to report that **Charlton "Pub" Whittier** is living in a nursing home in Harrisburg, outside Toledo, Ohio. He is too weak to walk. His wife, Ruth, has moved next door to the home and their son lives nearby. There comes a time when a spouse cannot cope with caring for her loved one at home. . . . **Albert Libbey** in Branford, Conn., is in good health. His wife, Carolyn, died two years ago, and he now has two grandchildren living with him. **Emily May Bixby** of Methuen, Mass., died on August 19, 1992. She was a biochemist. After receiving a BS degree in chemistry from Tufts University, she joined our Class to earn a master's degree in science followed by a doctorate from Case Western Reserve University in Cleveland. For more than 30 years she was a chemist in the field of mental deficiency at the Wallace Research Laboratory at Wrentham State School in Wrentham, Mass. While there she wrote several articles on biochemical studies of mental deficiency.—**Joseph C. Burley**, secretary, 1 Harbourside Dr., Delray Beach, FL 33483; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06405

28 65th Reunion

It is with regret that I do not have more news in this "almost the last" issue of the *Review* before our impending 65th Reunion in June, but the planning by the Alumni/ae Office is on schedule for what promises to be a notable occasion for those who attend. You are urged to respond to all communications from the Alumni/ae Office and make contact with other '28ers to spread the word, stimulate interest, and provide helpful information.

Some of those who have expressed intentions and will attend if possible are: **Harold Blackwood, Henry Buntschuh, George Chatfield, Earl Crawford, Newton Foster, Robert Hennes, Arthur Josephs, Ernest Knight, Henry Lamb, Mary Nichols, Harlan Paige, George Palo, Carroll Smith, Hermon Swartz, Frank Taylor** and **James White**. There will be additions to the list next month.

As have many of our classmates, **John (Bud) Wilbur** has moved into a retirement home in Peterborough, N.H.

Our class membership has been reduced by two more deaths. Professor/Commodore **Henry Adrian Schade** died on August 12, 1992, and was buried at Arlington National Cemetary. Professor Schade specialized in aircraft carrier production during World War II and directed the Naval Research Laboratory. He studied shipbuilding in Germany before the war; and during and after the war, he analyzed German scientific and engineering research. . . . **Bidermann Thomas duPont** died on August 26, 1992. He was a pioneer in the powder-metals industry and active in community service including NAACP, Boy Scouts of America, and professional hockey (Johnstown Jets and North American Hockey League). Our condolences to their families.—**Ernest H. Knight**, secretary, Box 98, Raymond, ME 04071

29

Please send news for this column to: **Karnig S. Dinjian**, secretary, P.O. Box 83, Arlington, MA 02174, (617) 643-8364; (603) 926-5363

30

This month's Notes are being written aboard the MS *Polaris* on the Amazon River. Earlier this month Louise and I flew to Belem, Brazil, via Miami for a Lindblad-sponsored 2,000-mile cruise up the Amazon to Iquitos, Peru. The *Polaris* carries 80 passengers and a fleet of 12-passenger, outboard-driven, pontoon-supported Zodiacs that provide an effective means for exploring the many Amazon tributaries. Usually we make an early morning and late afternoon Zodiac trip each day to avoid the midday heat while observing the local flora, fauna, and people. One of the principal surprises of the trip has been the comfortable weather we have experienced. Although we are only a few feet above sea level and only a few degrees from the equator, daytime temperatures have been for the most part in the 70s and 80s with a top temperature so far of 95°. Those of you with long memories may recall that this is the second time the Notes have been written on a river boat; the August '87 Notes were written aboard the MS *Xi Ling* on the Yangtze.

Once again I have the pleasant task of reporting the re-marriage of a classmate. Last July 4th, **Jack Latham** married Charlotte Stone Saeed in Mexico, N.Y. As previously reported, Jack's first job after graduation was at a duPont plant near Charleston, W.Va., and my first job was at Union Carbide's Charleston plant. Shortly after we went to work,we met on a street in Charleston, learned that neither of us had satisfactory housing and thereafter lived together for several years. During that period we discovered that the Presbyterian minister had three lovely daughters who became part of our circle of friends. Jack's new bride, Charlotte, is the second of the three Stone sisters. Her first husband, Sam Saeed, was an Iranian whom she had met on a teaching assignment in Teheran. He died several years ago.

When I first acquired the job of class secretary in 1960, I prepared a "working" list of classmates comprising those with undergraduate degrees plus those graduate and non-degree students who appeared to have a continuing interest in MIT. In recent years I have discovered that these criteria excluded a number of students whose activities should have been previously reported. The foregoing comments are *a propos* of a letter that has come in from **Margaret Van Pelt Vilas.** Margaret has an AB degree from Vassar, a B.Arch. from the Columbia School of Architecture, and an M.Arch. from MIT in 1930, a truly impressive set of credentials. Moreover she has since used this education in numerous ways, for example: as a draftsman, renderer, tool designer during World War II, architectural designer, and self-employed architect with an office in New Haven,Conn. Margaret and her husband,who died in 1988, were avid sailors; including day sailing on weekends and vacation cruising, they "covered a lot of water." Margaret remains active as a water colorist and "half-time"painter. She has been a member of the American Water Color Society since 1932.

Win Hartford's manifold activities and kudos have been previously reported. One new item in his latest communication is the fact that he has been acting as an expert witness in certain Superfund liability cases. He comments, "The bad science that comes to light in these cases is appalling, both plaintiff's and defendant's lawyers have escalated legal costs without any concern for the facts." . . . From Vancouver, B.C., **Joe Kania**, who at 92 is, I think, our oldest survivor, reports that he still does considerable traveling. In June 1993 he plans to fly to London, board the Crystal Harmony for a cruise up the Norwegian coast to Murmansk and back to Copenhagen, fly to his "hometown" Vienna for a visit with relatives, then return to Vancouver in July.—**Gordon K.Lister**, secretary, 294-B Heritage Village, Southbury, CT 06488

31

This has been an unusual fall for my region of New England. Usually we get our first frost around the first of October—this year it held off and we didn't get a killing frost until November first. I think part of it was the effect of the winds, most of which have come from the east, which has had the effect of keeping the coast area somewhat warmer than the interior. It's really unusual to be picking tomatoes for an extra month!

Charles Edwin Starr of Summit, N.J., died July 12 after a long illness. He was a very busy person while at MIT—on the *Technique* staff, serving as advertising manager and general manager, and a member of Pi Delta Epsilon, Osiris, Chemical Society, Institute Committee and Field Day Marshal.

The *Madison* (N.J.) *Press* reported that "after he graduated in 1936" he taught courses in chemistry at Miami University. It must have been after "1931" as he was chief chemist at Seneca, Ill., in 1935; but he then went to Esso Labs at Baton Rouge as chemical engineer, then to New Jersey where he served as assistant director. He became manager of the public relations department of Esso Research and Engineering Co. in New York City, then deputy coordinator and general administrator of Esso Research and Engineering Co. in Linden, N.J., then VP, retiring in 1969.

He is reported to have had a major role in the development of the high octane fuel that was used by the British Air Force during the Battle of Britain. He was reported to have held 10 patents and was the author of 11 technical articles relating to petroleum research, as well as one book on organic chemistry. He was predeceased by his wife, Olive, whom he married in 1934. He was survived by two sons, Ed of Putnam Valley, N.Y. and Steven of Oklahoma City, Okla. and by six grandchildren.

Carrington Mason of Houston, Tex., died March 12, 1992. Like the rest of us, he had a tough time getting started. He did some surveying for a gold mine in California and continued to alternate stints gold mining in Arizona and California with studies at Harvard Business School for a year and then graduate work at Tech in Course XV. He then went on to work as a sales analyst in Illinois, a sales engineer for custom built machine tools, from the North Carolina line to New Haven, and an industrial engineer (after training in Cincinnati) in a plant making alpha cellulose in the South. He was a lieutenant in the U.S. Navy from 1943-46, then industrial engineer in a rice processing plant in Texas in 1948 and, being in Texas, that led naturally to oil and gas—with the Houston Natural Gas Corp., achieving the position of executive assistant VP by 1955 and assistant VP in 1956, as well as general manager of the Distribution Division. He retired as Senior VP in 1971.

In the process, Carrington was recognized for a National Distribution Achievement Award by the American Gas Association and the Southern Gas Association Distinguished Service Award. He served as director and as chair of the Distribution Section and chair of an ANSI Standards Commission, as VP of the Texas Society of Professional Engineers, president of San Jacinto Chapter of Texas SPE, and director and VP of Hope Foundation for Retarded Children.

Apparently that did not take up all his time as he also served as a member of the executive board of Sam Houston Council BSA, chair of Council Advisory Committee on Scouting for Retarded Children, president of Brazos Presbyterian Homes, consulting editor, *Gas Distribution for Pipeline Industry*; executive secretary, Texas Gas Association; Distinguished Eagle Scout; member and past president, Houston Engineers Club.

Carrington is survived by his wife, Dorothy, and a daughter, Mary, living with her in Houston, and another married daughter Elizabeth M. Marshall, also of Houston.

As a class we all ought to be proud of Carrington's accomplishments, and particularly for devoting the time he must have to the Scouts, and to professional organizations.

I had a very short note from **Dick Ashenden** that he and Peggy spent three weeks in Costa Rica in February 1992, but no details.

On September 24, Mildred and I went to a SAME meeting at the South Portland Coast Guard building there. **Ed Norris** and Florence attended—they were both in fine shape. The topic at the meeting was the construction of a building, over the large dry dock at Portsmouth Naval Shipyard, to make the servicing and overhauling of submarines easier in cold or wet weather. The lecture also outlined the procedures that were used to facilitate the construction by coordinating the work of the various groups involved, and proved to be a great improvement in management procedures.

October 23, I woke up to find a limb on one of the 100-year-old oaks in my yard had become tired, and broke down (the limb did not break free of the tree about 25 feet up—but did reach the shrubs about 30 to 50 feet away, doing some damage). This has kept me busy clearing up after it, including cutting and splitting the limb for firewood. (I had to get an arborist to cut the limb free of the tree.) Now I'm busy trying to put the garden to bed and clear up the leaves (I have a large yard, 1 3/4 acres).—**Wyman P. Boynton**, secretary, 668 Middle St., Portsmouth, NH 03801

32

At our 60th reunion we had an "open mike" session. We called it "Reflections of Octogenarians." Several of our classmates came forward, told us how they chose MIT, how they started their careers, and some entertained us with a story or a song. It was interesting to see how chance played an important part in their lives.

First, **Arthur Marshall** accepted his election as class treasurer. He jokingly assured us how scrupulous he would be in protecting our funds—unless, of course, he was cut in on a deal. He recalled how important music was in his undergraduate days—he played with the Techtonians. Arthur wanted us to remember our classmates **Bob Semple** and **John Finnerty** and, in fact, all our departed members. He hopes our living classmates can stick together and celebrate our 65th. His first job was with an orchestra on a cruise ship. In order to bring his girlfriend along he had to marry her, and now he and Rebecca have been married 60 years. Is that the class record?

Harry Johnson took the metallurgy course. When he entered MIT, there were 10 jobs for each graduate; when he graduated there were 10 men for each job. He bounced around for seven years, then came back to MIT for an extra degree (on scholarship aid and a student loan). Then MIT helped him get employment at Westinghouse as purchasing manager. He says he owes much to MIT for his life accomplishments. . . . **Dan Brookfield** said ever since he was 7 years old he knew he wanted to go to MIT. His high school teacher tried to discourage him, but Dan wanted his own laboratory so he could invent things. He got through MIT with some help from Frank Chaplin, and in due time he had his own lab—Brookfield Engineering. . . . **Wendell Bearce** likes to recall what people thought of him as he progressed in his career. He received scholarship aid from a gentleman in Back Bay and requested architectural engineering. However, that was closed to him because there were 30 better students than he. Wendell's father suggested mining, so Wendell told his benefactor that was what he would study. The benefactor retorted, "Young man, you are a person of extremes." Upon graduating, he obtained work as superintendent of a mine in Pennsylvania. In an argument with a big burly Finnish miner, he was asked where he got his experience. "At school—MIT." The miner retorted, "No wonder you don't know anything." Wendell made his way in the world and eventually started his own consulting firm.

Manley St. Denis of Honolulu, Hawaii, told us that he was brought up in Trieste. Everybody loved Trieste. In fact, he saw it change its nationality five times. His home overlooked the Adriatic Sea. Manley was entranced with a ship, *Valencia*, that made daily trips to Venice. When he came to America in May 1928, he thought he would like to be a naval architect. He went to a library and, after two days, had worked his way down to M. He was tired, saw MIT, and decided that's where he wanted to go. He passed all his entrance tests except English. But because he was a foreign student, they gave him a simple test that nobody failed. When he applied for admittance to the Naval Architecture Department, he was interviewed by the head, Professor Rubinson. "Why do you want to be a naval architect?" he was asked. Manley told him he was thrilled daily looking at the ship, *Valencia*. The professor showed him a book of ships. Manley slowly turned the pictures and finally exclaimed, "That's the ship, and you are the designer!" The professor said it was the greatest compliment he had ever received.

Later Manley learned that word was passed around the department—he was to be treated special—and he never flunked a course. Manley finished by singing four stanzas of the song, "Oh Tech, as I look back to thee, my eyes are filled with tears. I'll never forget those wretched years. I wish I had been sent to jail before I went to Tech."

Enough for now. I have a few more stories that I will use when I run out of material for class notes. So keep writing—I don't want to miss an issue. Our numbers are dwindling.—**Melvin Castleman**, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

33 60th Reunion

We hope that you all are getting prepared—June 2 in Cambridge is the starting day for our 60th Reunion, and it will be a merry time at dinner. Remember: "Take me back on a special train to the glorious Institute. I yearn for the inspiration of a Technological Toot!" Very soon the information for signups will arrive. Analyze it carefully. Possibley, it is the final chance of our lifetimes to have a close reunion of classmates.

At this time very little information about activities is arriving. We hope the reunion will be an inspiration to do better!

We have several deaths to report, and I have asked **Bill Klee** to let me handle the obituary of one. **Dayton H. Clewell** died on November 11. Dayton had been fighting a serious illness for the last five years, and his death had been expected. He is survived by his daughter, Nancy Forsdick, his son, Don Clewell, and their children. Nancy was



Treasurer of the Class of '33 Charles Britton and his wife, Jane, both celebrated birthdays aboard the* Nantucket Clipper *on a trip exploring Chesapeake Bay and the Hudson River last October. The cruise was organized by the Alumni/ae Travel Program. The multiple-span truss in the background is a former railroad bridge near Poughkeepsie.

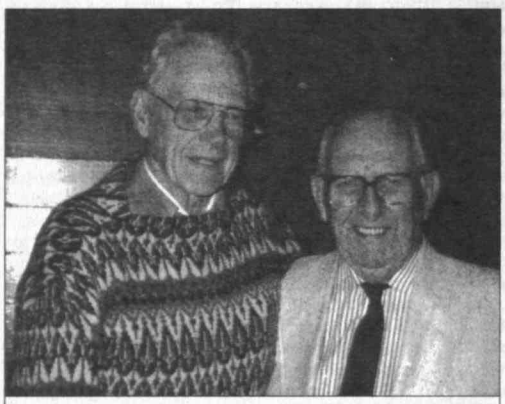
his caregiver for five years. Dayton was very much a leader—on campus, in business, and science. At MIT he was a leader in fundraising, served as MIT Corporation member, was awarded the Bronze Beaver, and was class president for 10 years. He held 20 patents, was editor or co-editor on 15 publications, and was senior VP at Mobil Oil at the time of his retirement. He was also director of Cordis Corp., and held a number of positions in organizations involving energy research, science in management, and efforts to improve the environment.

Dayton had many gifts, and was a personal friend to many of our classmates. I recall two incidents. In Dallas, Dayton was in research at Mobil, and I was at Procter and Gamble, and our families were close. Years later, as Mobil VP he took time to visit when my father died.

If some classmates wish more information, write to Nancy Forsdick, 422 Oliveta Place, La Canada, CA 91011.—**Richard L. Fossett**, class president, 10931 Allen Dr., Garden Grove, CA 92640 (Send news to **William B. Klee**, secretary, P.O. Box 7725, Hilton Head Island, SC 29938)

34

Larry Stein has sent the news for this report. From **George Fowles**: "I usually have the pleasure of seeing **John Hrones** at directors' meetings in Sarasota several times each winter. . . . **Walter Bird** and his good wife often come to our monthly MIT meetings. Beth and I spend the summers in Highlands, N.C., in the mountains. We are getting ready now for a trip on the *Sagafjord* from New York to Montreal, stopping in Cape Cod, Boston, Bar Harbor, Halifax, and Quebec."



SURPRISE! John Hrones, '34 (left), was in on the surreptitious plans to help Bissell Alderman, '35 (right), celebrate his 80th birthday. Alderman's wife, Mary (daughter of Karl Taylor Compton), took the photo.

John Hrones, class president, was in Jaffrey, N.H. until October 15. "Went to Alumni Day but health problems forced me to drop out before the luncheon. Except for a bad knee I am fine now. I hope to see many classmates at the 60th Reunion." John sends the following news. "**Al D'Arcey** has been working on a genealogy of his family and sent interesting information about his career. From 1934 to 1943, he was with Mason-Neilan Regulator Co., 1944-1946 with Marine Division of Bendix Aviation Corp., 1946 with Stevens-Arnold Corp., and 1946-1967 with United Shoe Machinery Corp. He has been involved in the design and development of numerous machines and machine elements including flow valves, combustion control systems, hydraulic control systems, shoe machinery, nuclear power plant components, and weapons systems. He holds a number of patents. Al is a daily golfer. I spent an afternoon with Mary and **Bissell Alderman** at their lovely home on the slopes of Mt. Monadnock in Jaffrey, N.H. Bissell has had a longstanding association with Williston Academy (now the Williston Northampton School). He is a graduate of Williston. He was the architect of the present campus, including the hockey rink, located in East Hampton, Mass. He has served as a trustee. . . . I saw **Bill Leete** at a recent MIT Club meeting in Sarasota. Bill has just moved to Bay Village of Sarasota, a retirement community where Wendy and **Wally Bird** live. Bill was active in the formation of The Siesta Key Condominium Council and has served as its treasurer for a number of years."

From **Larry Stein**: "We are still doing business at the old stand in Hingham. Jerrie has had replacement operations on both hips and can now keep up with anyone. We had a lovely vacation in the Rockies in August, spending a few days in Leadville, Colo., during "Boom Days," an annual celebration of the town's history. There were events like a long parade, a burro race, rock drilling contests, an outhouse race, and a lip-sync singing contest. All great fun. We hope to see many at the 60th.

Thus endeth the notes.—**Robert M. Franklin**, secretary, Box 1147, Brewster, MA 02631; **George Bull**, assistant secretary, 4601 N. Park Ave., Chevy Chase, MD 20815

35

Our class president, **John F. Taplin**, is a very busy man I learned on my recent trip. He is involved daily at the Harvard Medical School. Now he has established the Funds for Discovery Program, which awards $50,000 each annually to 10 eligible assistant and associate professors in basic science departments at Harvard Medical School, Harvard School of Dental Medicine, New England Regional Primate Center, and MIT. The objective is to allow young junior faculty members to transform their promising ideas into real products or processes for the public good.

One of the highlights of my visit with **Walter "Stocky" Stockmayer** and Sylvia was a conducted tour of Dartmouth College, starting with a stop in Stocky's office and ending up in the basement of Baker Library. The walls of that library room are covered with fascinating murals painted during 1932-1934 by the Mexican artist Jose Clemente Orozco. The college trustees sponsored him painting on themes of his own choosing as an educational experience for the student body, with the artist addressing his audience visually rather than verbally. You must see this to appreciate it. If you find yourself anywhere near Hanover, N.H., take the time, read the interpretation, and enjoy.

Now that we know Bill Clinton is our next president, take pen in hand and write to **Allan Q. Mowatt**, secretary, 715 N. Broadway, #257, Escondido, CA 92025

36

A telephone canvass of a dozen classmates in southern Florida for hurricane Andrew damage produced no headline news—thanks in some cases to cement block construction, cement "Bermuda" tile roofs, and no large trees nearby to fall on them. On the Atlantic side, **Harold Miller**'s 15th floor condo in Hollywood was near the eye, but his oceanside windows held fast against the stormy blast. He and Ruthie were in England at the time after traveling in Europe. . . . **Norm Robey** in Coral Springs had some harm to solar panels in the roof with minor interior damage. He and Grace were in Tulsa at the time, and relatives and friends from Pompano Beach moved in to escape their own problems. (**Bernie Schulman** in Pompano has not answered messages left on his telephone).

On the Gulf side, it was not so good for Mary Louise and **Gordon Thomas** on Marco Island—their concrete-tiled roof held (many clay-tiled roofs did not), but one window imploded, and that room was flooded and trashed. Shards of glass were driven into the furniture, the far wall, and a hall beyond; water got in a typewriter and calculator; trees were uprooted or tops broken off. They were at their summer place in Canada at the time. Gordon flew down on day three, but repair businesses were swamped with work, so he went back to Quebec. . . . Otherwise, not bad. **Walter Squires, Mal Holcombe**, and **Bob Caldwell** in Naples, and **Leonard Stoloff** in Delray Beach told only of damage to trees, pool enclosures, or porch screens in their neighborhoods. But they and other classmates yielded items of interest, and it will take a couple of issues to cover them all. Walter is in good health and had been swimming in the Gulf that day. His wife, Elizabeth, has to be careful moving about, and they gave up their New Jersey summer home after our 50th Reunion. He told of having dinner with Jean and **Pete Weinert** in November each year when they use their time-share at a Marco Island resort.

Mal Holcombe mailed another clipping about **Dave Varner**'s death. They were roommates at the Deke house, and in 1936 both applied for examiner's jobs in the U.S. Patent Office, meanwhile studying law. Ultimately they practiced and prospered, Dave in Washington, Mal in N.Y.C. He and wife, Vivian, are well, "all things considered." To wit: they walk two or three miles a day, notwithstanding Mal's congenital heart problem, a quintuple bypass and several years of a skin capillary congestion problem. He spoke of seeing **Tom Nelligan** and **Harry Hazelton**, year-round residents at Hilton Head Island. . . . **Leonard Stoloff** (Course VII-biology and public health) has spent his entire adult life in these fields. He is still in touch with former colleagues at the Food and Drug Administration and MIT's Department of Biology on current concerns. His latest of some 100 published papers are dated 1989, 1991, and 1992. Particularly in studies of aflatoxins and mycotoxins, Len worked to establish, or debunk, the validity of claims that could harm farmers, industries, and/or humans.

Jim Webster's home on Kauai was only a few miles from the eye of hurricane Iniki September 11. The house, "built like a battleship," held against the 175 m.p.h. wind, but 12 large trees fell across the huge center beam, caving in the roof, the garage, and his tool shed. Compounding the problems, 40 miles of pole line had to be rebuilt, and telephones and electricity were dead until October 10. Rebuilding will take most of the winter, so Jim and Anne are remaining at their summer home in Kirkland, Wash. The four other classmates in Hawaii are on islands unaffected by Iniki.

A letter from **Bob Lutz** invites Phoebe and me to visit them in San Diego and see the Copley Cup crew regatta this spring "on condition that Phoebe bakes and brings a loaf of her wonderful bread." We would be glad to bring a loaf for each of us, but another grandson's college graduation and a planned trip through several neglected mid-country states will make a busy time.

Cheers for the lives of **Merton Baker** and **Joe Gratz**, both Course VI. Mert was 87 when he died August 11, having studied at Wentworth Institute and Rensselaer before entering MIT. After World War II service in the Navy at Boston Shipyard, where he devised a counter-measure for detecting magnetic mines, he designed a number of other patented electrical and mechanical devices. Throughout his adult life, he enjoyed giving piano and organ recitals. His wife, Hazel, died in 1987.

When I called **Joe Gratz** in Tampa about the hurricane, his wife, Ann, told of his death June 14 on a cruise from Hamburg to Russia. Joe was with us from 1932 to 1934, then transferred and graduated from Harvard. But he never lost interest in the Institute, supporting the Alumni Fund and reading the *Review*. In World War II he was a Signal Corps captain stationed in Australia and New Zealand. His career in radio and television broadcasting was with CBS until 1952. He then moved into station ownership and operation, successively and successfully in Omaha, Tampa, Daytona Beach, and Deland, Fla. Ann continues at 5151 San Jose St., Tampa, FL 33629.—**Frank L. Phillips**, secretary,

1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

37

One of the really nice things about the 55th Reunion was the generous gift that **Pete Reitz** presented to every member of the class. As you may remember, it was a tape on which he had personally recorded most of the Big-Band songs and vocalists of our era. Letters of appreciation poured in to **Phil Peters** and **Dick Young**, saying, "Please thank Pete for me." They came from many of the absentees, including **Cameron Mitchell, Vanburen Hansford, Ed Peterson**, Betty and **Jack Hanlon, Ray McFee, Howard Lind, Ann Zinchuk**, and **Leon Menzel** (via his wife, Elizabeth, since he has had a series of strokes).

Joe Heal, our long-time treasurer, was surprised to have the postman place a package at his door. It was the plaque given to all the officers who have served our class over the years. Joe writes that he may soon have to stop bringing Marion home every day since she cannot stand because of her Parkinson's.

Howard Lind is enjoying his retirement at Wells Beach, Maine. He was director of the Laboratory of the Maine State Public Health Department, from which he retired in 1982. . . . **Van Hansford** spends summers at his summer place on Canandaigua Lake, N.Y., with his children and grandchildren. His home is in Marco Island, Fla. He says, "I am completely retired. My son bought out my business and is doing a much better job than I ever thought of doing, so that is a real source of satisfaction. I play a lot of golf and still look at the pretty girls for some reason."

Cameron Mitchell writes that he took early retirement from Southern States, Inc., back in 1965, but it sounds like he really hasn't retired yet. He is a director of three banks and is active in Scout work, United Way, Kiwanis, and Georgia Safety Council, to mention a few. His four daughters and eight grandchildren are spread over the South in Tampa; New Orleans; Arlington; Tex.; and middle Tennessee. He is still in Hampton, Ga., and plays a fairly active game of badminton once a week.

Joe Keithley writes that he enjoyed the reunion in Newport and Cambridge. He still works almost every day at Keithley Instruments, Inc., which he founded. He is working on a history to be called *Story of Electrical and Magnetic Measurements*, which he plans to finish in the next 12 months. Good luck, Joe.

Leon Strauss, Jr., retired as president of the Hearing Aid Co. in San Rafael, Calif., back in 1967. He travels in his large Vogue Country Club Motor Home. He is interested in computers and flight simulators. . . . **Bob Monsarrat** lives in Bexley, Ohio. He retired as president of Designers Associates in 1991 to do some traveling.

Charlie Reed lives in Needham, Mass., and is treasurer of the Charles H. Reed Export Co. After 45 years of traveling overseas in his business life, he is now catching up on the United States. Listen to his itinerary: "This year, Rocky Mountain National Park, Trail Ridge Road, Greeley Fourth of July Stampede, Tucson, Ariz. Year before, it was Santa Fe and, before that, Grand Canyon and the National Parks."

Keep your newsy tidbits coming.—**Robert H. Thorson**, secretary, 66 Swan Rd., Winchester, MA 01890; **Leonard A. Seder**, assistant secretary, 1010 Waltham St., #342B, Lexington, MA 02173

38 55th Reunion

In October you should have received the initial mailing of our 55th Reunion of June 1-4, 1993. If you were too preoccupied then to return the questionnaire and Class dues (only $25 for the past five years), do take a moment to do so now. It will be a great help to those of your classmates who are developing all our activities for Martha's Vineyard and Cambridge.

Our president, **Horace Homer**, has just received a letter detailing 1992–93 recipients of the Class of 1938 Scholarships. Our fund continues to increase and is now one of the largest of its kind at the Institute. This year there are eleven students designated as 1938 Scholars—four have their awards renewed; seven are new to our fund. They represent nine different departments and ten different states.

One, a senior, is a three-time recipient of our scholarship. Not only has he taken leadership roles in a variety of extracurricular activities, but he works 15 hours a week as a math tutor and hopes to pursue a PhD in anticipation of a career in teaching or research. Another, born in Saigon, grew up in Seattle, where her family lives. She is a junior in biology with research experience in oncology, specifically on growth rates and metabolism in young girls. In addition to student committee work, she participates in intramural sports, including hockey, tennis, volleyball, and basketball. She has worked in a convalescent center near her home and as a volunteer at her local hospital. Not surprising that she plans a career in medicine. Isn't it satisfying to be supporting such young people!

It is with sorrow we announce four deaths in this issue.

Joe D'Angelo passed away in January 1991, in Albuquerque, N.M. We would welcome any background from classmates who kept in touch. From our *Technique*, Alumni Registers, etc., we know he commuted from Watertown, Mass., was in the advanced ROTC, graduated in chemical engineering, subsequently served from 1942 to 1946 in the Army Ordnance Dept., received the Army Commendation Ribbon, and was captain upon his discharge. Immediately after graduation he went to work for Reichhold Chemical and was later promoted to VP—a position he held presumably until retirement. Subsequently he was with Polychrom Corp. on the Hudson and later with Management Recruiters, Inc., in Stamford, Conn.

Cliff Nelson died September 21 at a hospital in Portland, Maine. While at MIT he branched out from his electrical engineering major into nuclear physics and biology, which set the stage for a remarkable career. His early jobs included research at the National Cancer Institute, radiation oil-well sampling, EEG lab at Mass. General Hospital, as well as electrical engineering jobs. In 1953 he earned a doctorate from the University of London in electrocardiology. He later became an assistant research professor of medicine at the University of Utah. In 1956 he carved out a distinguished career at the Maine Medical Center, retiring in 1983. He became a world leader in the field of vectorcardiography, the study of electrical forces in the heart. He published well over 100 professional articles, lectured widely, took part on numerous boards (including the editorial board of the *American Heart Journal*), was a fellow of the College of Cardiology, professor of biophysics at Boston University, a career investigator for the American Heart Association, and an established investigator of the National Institutes of Health. Cliff still had time to continue as an amateur radio operator (receiving a 55-year award in 1989 from the Quarter Century Wireless Association), was active in the Nature Conservancy, Maine Audubon Society, the AARP, and was instrumental in the establishment of the Gorham Land Trust. Our sympathy to Jane, his wife of 50 years.

John Wheale died September 14. To our sorrow, we learned from his Theta Delta Chi brother, **Phil Sellers**, that John had been in considerable pain at the end. So far, no additional news from family or others. We do know that most, if not all, of his career was in sales management for International Silver Co. of Connectiut. And from MIT records we know he served in the Army in World War II from 1939 to 1946 and was a major upon retirement. We'd appreciate any additional information from his friends.

Your secretary had a call from **Bill Whitmore** of the death of his wife of 46 years, "Bibba" to friends and Dr. Elizabeth Sherman Arnold professionally. Both earned doctorates in 1941 from the University of California. And both worked for the Navy in World War II—Bibba on a Navy team of cryptographers cracking Japanese codes, for which she earned a meritorious service award. Later she worked for Lockheed Missiles and Space Co. where, incidently, Bill became assistant to the president and chief scientist for ocean systems—for Admiral "Red" Raborn, if I recall correctly. Bill, the two of you were quite a team, and our deepest sympathy goest out to you.

To close on a happier note. . . . a Greater Boston newspaper recently ran the headline, "MIT Hands Out Annual Ig Nobel Awards." What has that to do with the Class of 1938? Lots! We all know about Nobel Prizes. If you are not familiar with the Ig Nobel prizes, just say it out loud fast. Then you will understand why former L.A. Police Chief Daryl Gates was awarded the Ig Nobel Prize for Peace for his "uniquely compelling methods of bringing people together;" why Michael Milken, father of the junk bond, was awarded the Ig Nobel Prize for Economics but could not be present to receive it personally, having a 15- to 20-year previous engagement. By now you may have guessed that this glorifying of the absurd was financed by a grant from the Fund for Humor at MIT established in the will of our late classmate, **Peter de Florez**. A year ago, four honest-to-goodness Harvard and MIT Nobel Laureates, bedecked in funny hats and false noses, were among the dignitaries at this event honoring achievements that cannot or should not be reproduced. Some other Ig Nobel recipients have been: for physics, Thomas Kyle, detector of atoms, for his discovery of the heaviest element in the universe, Administratium; for biology, Robert Graham, for pioneering the development of a sperm bank of Germinal Choice for donations from real Nobellians and Olympians.

The first grant from Peter's fund went to publish the 150-page *Journal of the Institute for Hacks, Tomfoolery and Pranks at MIT*, which you all should have ($19.95 from *Technology Review* or the MIT Museum). About 20 projects have been supported by this fund, including an MIT hack exhibit entitled "Crazy After Calculus," a Clown Troupe for the Community, and several Dramashop productions.

Actually, only one-sixth of Peter's $3 million bequest went for his Humor Fund. His major impact was the establishment of the Peter de Florez Professorship, the first recipient being Jay Keyser, Associate Provost for Institute Life, focusing on the quality of life at MIT.—**Don Severance**, secretary, 39 Hampshire Rd., Wellesley, MA 02181; **Ed Hadley**, assistant secretary, 50 Spofford Rd., Boxford, MA 01921

39

George Beesley, chair of the Cardinal and Gray Society, announced **Ruth Pitt** joined the Program Committee. About 50 members attended the 1992 autumn meeting at which Irwin Sizer, retired dean of MIT's Graduate School of Bio-Medicine, spoke on bio-medicine at MIT. About 200 postgraduates are engaged there in genetic research. A new $70 million building, with labs, is being constructed for this school. The Cardinal and Gray Society is scheduled to meet during June Week 1993.

Pete Bernays returned from the Alumni/ae Leadership Conference at MIT to Columbus, Ohio, where he continues service in the Educational Council.

Joe Dana and Jean are active on the Cape. Among alumni they see regularly are **Smitty Curtis, Bob Pratt** and Pam, Matthew Abbott, '38, and Ed Kispert, '41. In Boston, Joe does class treasury business with **Fred Grant** for our coming 55th Reunion, and with George Beesley who manages the 5,000-member Cardinal and Gray Society. Joe and Jean have travelled to Alaska. They drove, bicycled, and barged in England and went sailboating regularly in the Mediterranean. On three occasions they just happened to run across **Bill Pulver** and Adie at U.S. ski resorts. . . . **Phil Bush** and Margie enjoyed their second auto trip through Spain and

Portugal. They started near Gibraltar and drove north for a pleasant three weeks.

Morrie Nicholson attended a Theta Delta Chi reunion in Asheville, N.C. The MIT group included Sam Brown, '34; Gordon Burns, '34; Jim Eder, '34; Austin Cross, '35; Art Gilbert, '35; Bob Lindenmeyer, '35; Phil Sellers, '38; and Morrie.

Bill Pulver and Adie registered to attend and golf at the MIT three-class mini-reunion in Naples, Fla. Bill, it may not lower your golf score, but reading "Keep Your Eye on the Ball," on sale from *Technology Review* Books, will add another dimension to your game. Classmates who excelled in 8.01 and M11 and who read the book can see what scientific derivations have done to the structure of and flight characteristics of both golf balls and baseballs.

Gus Hunicke reports from 44 Banbury Crossing, Old Saybrook, CT 06475 his desire to respond to letters from classmates.

Manning Morrill and Connie, Bill Pulver, and Frank Phillips, '36, each mailed a *New York Times Magazine* extract from James Gleick's new book, *Genius: The Life and Science of Richard Feynman*. Six weeks later, Mr. Jim Holt wrote in the *Wall Street Journal* under the heading "A Philosopher and a Playboy" a most-readable and comprehensive review of Feynman's achievements, books and accolades which culminated in the 1956 Nobel Prize for his theory of quantum electrodynamics. During freshman year, those of us who had troubles completing 8.01 quizzes within the allotted hour can appreciate Holt's interpretation of Feynman: "...Feynman's theory tied together in an experimentally perfect package all the varied phenomena at work in light, radio, magnetism, and electricity...anti-particles can be regarded as ordinary particles moving backward in time...." With genius to conceive the complex and the ability to explain it simply, it is small wonder that Richard Feynman uncovered the cause of the Challenger disaster and explained it by dunking an O-ring in a glass of ice water.

I had an interesting visit to MIT's Combustion Research Lab in Building 66 where I was impressed by work, under Professor Janos Beer, chemical engineering, in a well-instrumented experimental furnace. By optimizing the flow in a radially-stratified flame cone burner, emission levels of 70 ppm NOx and 56 ppm CO can be obtained with natural gas flame. Further reductions to below 15 ppm NOx were obtained when flue gas recirculation and steam injection were added to optimized gas flames.

We are saddened by news of the deaths of three classmates. **Bill Cutten** died September 19, 1992. He graduated in Course III and then earned a master's degree. Before retirement he served in project engineering for Burlington Industries. As a generous giver to MIT, Bill was an MIT Sustaining Fellow. He lived in Allentown, Pa. There were no other details.

From the *Burlington (Vt.) Free Press*: "...**James K. Gilmore** died in his home at Hyde Park, Vt., on September 17, 1992. His professional career included serving as geologist and head of quality control at the asbestos mines in Lowell.

"Mr. Gilmore served in various positions within the town of Hyde Park, including chairman of the water and light department, village trustee, school board member, and zoning board member. He was involved in establishing the Hyde Park Boy Scout Troop and maintaining a village ice skating rink for many years."

Bill Brewster, Fred Grant, George Beesley, and **Fred Schaller** phoned or sent a clipping from the *Boston Globe* concerning the death of **Gordon A. Pope**. He died October 20, 1992 in Huggins Hospital, Wolfboro, N.H., of cardiac arrest. Graduating with a degree in mechanical engineering and business administration, his first job took him to Argentina.

In 1940, before the United States entered World War II, Mr. Pope joined the British Army and later was transferred to the U.S. Army with the rank of captain. "He served with the 1st Engineering Battalion in North Africa and Italy, and with the Office of Strategic Services in China. Among the decorations he received were the Distinguished Service Cross, The Silver Star, the Bronze Star, the Purple Heart with two oak leaf clusters, the Croix de Guerre from France, and the British Military Cross.

"He left the army in 1945 with the rank of lieutenant colonel and came to Boston where he joined the consulting firm of Ernst and Ernst. He moved to San Juan, Puerto Rico, in 1951 and founded several businesses, among them F.F. Industries, Inc., a maker of tools and dies and of injection moldings.

"In 1980 he retired and moved to Ossipee, N.H. Two years later his first wife, Nancy (Shelton), died of cancer, and in her memory Mr. Pope commissioned the restoration of the Whittier covered bridge in Ossipee. Mr. Pope leaves his wife, Beatrix (Freeman) and two sons." A memorial service was held November 21 in the MIT Chapel.

It is 40 months since **Fred Grant, Ernie Kaswell, Fred Schaller, Aeron White, Irv Peskoe, Pete Bernays**, and others assembled and published the Class of 1939 50th Reunion *Technique*. According to my informal records, 48 '39ers died since our 50th.—**Hal Seykota**, secretary, 2853 Claremont Dr., Tacoma, WA 98407



GRIZZLY PROVES NO MATCH FOR MIT GRAD & HIS FISHING POLE

Harold Muckley, '39, went salmon fishing on the Kameshak River in Alaska last August with two of his daughters and a son-in-law. A bear they encountered was not pleased that its fishing territory was being trespassed upon and came within about 20 yards of the interlopers. Muckley stationed himself between his family and the bear, and won the standoff.

40

Recently, I received an updated Class Roster. It provides some statistical information that you may find of interest. Among the total of 663 class members listed, 102 received no degree, and 394 received a bachelor's degree. Three of these people went on to get a second bachelor's degree, 62 won a master's degree (one of these obtained a second master's), and 18 others continued their studies further to be awarded a doctorate. In addition, the first MIT degree received by 131 people was a master's, and 36 others, also considered class members, obtained doctoral degrees as their first MIT award.

Among the MIT activities in which classmates participated, or were granted awards, six were local MIT Club directors, six were Educational Council members, six have been Campaign for MIT members, and five have received the bronze beaver award. Another four people have received distinguished service awards, and seven others have served in various campaign and leadership positions for the Institute.

The only item concerning a classmate that I have this month is a note from John Mattill, editor emeritus of *Technology Review*, in which he told of a pleasant encounter with **Donald Ross** in Cape May, N.J. They participated in an Elderhostel to see the town's famous Victorian architecture and its well-known fall bird migration. Donald is retired after a career in the insurance field, and lives and travels in a large house trailer. When John saw him, he had just concluded a summer of traveling through 25 states to as far north as Bretton Woods, N.H. His permanent locale is in Dunedin, Fla.

I look forward to letters and calls from you to provide information for future columns.—**Richard E. Gladstone**, secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

41

Professor Ann Fetter Friedlander, noted economist and the first woman academic dean at MIT died Monday, October 19. She had been ill with cancer for several years. Dean Friedlander was our particular friend and inspiration as the Class of 1941 Professor of Civil Engineering and Economics since 1987. We all missed a recent opportunity to meet her again when her illness prevented her scheduled speech at our banquet during the 50th Reunion. Her career has been described in a tribute on page MIT 10 of this issue. **Sepp Dietzgen,** has written her husband, Stephen, to express our sympathy, but we also wish to express it here.

Will Mott, forwards a note from **Luis G. Jimenez Michelena**, at a Madrid, Spain, address. Our 1941 *Technique* shows his home then, as Caracas, Venezuela. In responding to Class Agent Will's thank-you for his 1992 contribution, Luis congratulates the Motts on their 50th Wedding Anniversary and their four daughters. He continues, "How many grandchildren? At the time of writing this note I have already accumulated 19 grandchildren and one great-grand one! Will, perhaps you may check the record for other classmates." Congratulations also to Luis. Are there any other '41ers up to his challenge?

Shortly before election day, a brochure arrived from **Bob (Wallace) Blake,** Republican candidate for state legislature from 36th District, Seattle, Wash. The brochure described his 40-year career at the leading edge of aviation development, including snapshots from Pensacola, Everett, Boeing Field, Afghanistan, and Cambridge, Mass. The latter, a now famous picture, showed his 1941 crew rowing on the Charles at the 50th Reunion. (He was identified by a large "BOB" lettered on his back!)

Hoping to have a congressman friend at last, and good news for you all, I called Bob after election only to find he had been swamped by a popular incumbent (40,000 to 10,000) and was about to leave on a vacation. Some detail emerges from Bob's letter (written Halloween) to Hal Seykota, '39 class secretary. The letter, thoughtfully passed on by Hal, who appreciates that all class secretaries need news, relates: "It all started on July 31 when the regular filing deadline expired with no Republicans for state legislature from the district. That gave the county chair one week to round up two candidates. After a call from him, some thought, and consultation with a couple of friends, I agreed to run against the incumbent Democrat, Helen Sommers. A formidable job since she has been in the legislature for 20 years, holding leadership positions on the most prestigious

committees. Over the years she has defeated in elections, among others, the present state attorney general, and this year's Republican candidate for governor.

After filing on August 7, I've been on my own. First exposure were interviews by the Municipal League and SEMAC (Seattle gays and lesbians). I did not fare well on those. Since then appearances at community clubs in three principal neighborhoods of the district went rather better. Also Chamber of Commerce, the Wooden Boats Club (an organization of live-aboard boaters and houseboaters), an elementary school, community college, Seattle Pacific University, a home for the homeless, a child development center, and interviews and questionnaires from two Seattle and three neighborhood papers. Every possible pressure group provided questionnaires—pro- and anti-gun groups, Planned Parenthood, teachers, fire-fighters, boaters, hunters, and wildlifers, you name it. Each had its loaded questions and expected politically correct answers. I couldn't possibly answer them all! I tried to answer selected questions thoughtfully; as a result *all* the groups are mad at me. Unanswered questions got you a "refused to answer" in their voters guides.

"Nicest day was the one I spent at the elementary school with two classes of fifth graders. They were full of questions, starting with, "How old are you?" and seemed attentive to answers. They don't vote but their parents do and I had leaflets for all of them! Had a good time with the houseboaters too. Was able to talk to them about my uncle, Garnet Blake, and the years he lived on a houseboat at the foot of Madison Street..."

Bob invited his opponent for a civilized lunch at the Women's University Club, talking little of politics, learning that she was originally from New Jersey, worked for 12 years with Mobil in Venezuela, and got her start in politics working for NOW. By election eve (Halloween) he was expecting the worst since she had scored 10,000 votes versus his 5,500 in the primary.

On November 5, Bob flew to Santiago, Chile, to catch the *Royal Viking Sun* for a cruise through the Strait of Magellan and on to Buenos Aires. After visiting an old friend in Rio, he will fly home the first week in December.

Hal Seykota provides a fitting postscript to Bob's letter, "I admire what Bob Blake has done to try to help the society in which he lives.Our world needs people like that! Bob promises to send us a report of his trip when he returns in December. Highlights should appear in a future issue.—**Charles H. King, Jr.**, secretary, 7509 Sebago Rd., Bethesda, MD 20817, (301) 229-4459

42

Greetings from Savita and **Nanu Amin** by way of a copy of Nanu's letter to **Lou Rosenblum**. Their daughter, Nandita, is designing a new house for them in a farming area not far from their present home. Lou continues to keep busy with graphic arts technology and other activities.

Al Hayes recently received FAA certification as an A&P (airframe and powerplant mechanic). He suspects that at the age of 71.66, he may be the oldest receiving that license. Al and Mollie, already planning for the 55th Reunion, will bring Spike, the family schnauzer, in their trailer.... **Bob Kraus** suggests that we have a Class of 1942 Think Tank at our next reunion. Hope that a lot of classmates will want to work on this with Bob. Get in touch with him at 3 Lesley Dr., Syosset, NY 11791.

Bill Robertson died in Charlottesville, Va. After retiring from Yale, he became senior scientist at the University of Virginia, where he worked on the restoration of sulfur-dioxide-damaged stone at Westminster Abbey. Jane and Bill had three daughters and three sons. Our condolences to them.—**Ken Rosett**, secretary, 2222 Americus Blvd., N., Clearwater, FL 34623

John (Jack) Wesley Sheetz III

1919–1992

Trickster with cups and disappearing balls, master of ceremonies of caps and gowns, engineer and university vice-president, sailor and computer wizard—John (Jack) Wesley Sheetz III, '42, was adept at transformations throughout his life. On November 18, he died of cancer at his home in Belmont at the age of 73.





Juxtaposing a photo from school days with a recent one was a feature of Sheetz' 50th Reunion Book for the Class of '42.

A native of Philadelphia, Jack Sheetz won a scholarship to MIT, where he distinguished himself as an outstanding physics student and as captain of the squash team. He served in the Navy after graduation, specializing in fire-control radar and working on early guided-missile programs. One of his favorite anecdotes came from that period of his life: Determined to contribute to the war effort as quickly as possible, Sheetz arrived at the naval base in Hawaii and rushed, duffel bag in hand, toward his barracks. Rounding a corner, he collided with a senior officer. When he recognized the officer lying on the ground as Admiral Nimitz, commander-in-chief of all Pacific forces, Sheetz feared he might launch his career with a court-martial. But Nimitz gave him a warm smile and asked, "Is this your first day here, ensign?" "Yes, Sir!," snapped Sheetz. Nimitz laughed. "I hope you have a good tour here," he said, "but stop sweeping officers off their feet, son." Sheetz went on to became officer-in-charge of the Pacific Fleet Radar Operator's School, rising to the rank of lieutenant commander. In 1944 he married Jane Gowans in Honolulu.

Following his discharge, Sheetz returned to MIT, earning an SM degree in physics in 1947 while also becoming the undefeated Massachusetts champion in squash. After service with the Office of Naval Research in Washington, D.C., eventually heading the staff of the Naval Research Advisory Committee (with responsibilities for nuclear propulsion systems), in 1952 Sheetz joined MIT's Lincoln Laboratory, where he worked on the distant early warning (DEW) project.

Sheetz' first major professional transition came when he left defense-related work for university administration. He held a number of senior positions at MIT, including executive director of MIT's Second Century Fund. Kresge Auditorium was completed under his leadership. He was also the Institute estate secretary, with responsibility for public functions, such as organizing Commencement from 1956–63.

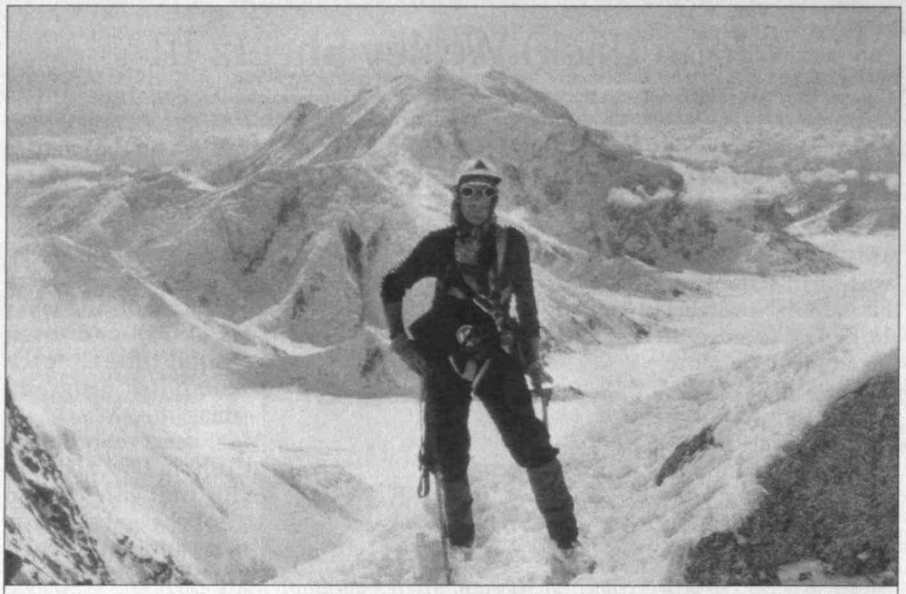
In 1964 Sheetz moved up the Charles River to the Harvard Business School to become director of resources. Four years later, he went on to Tufts, where he was vice-president for fund raising and public relations (he organized the inauguration of President Jean Mayer in 1975) and even found time to teach computer programming.

Sheetz retired from Tufts in 1979, and after his first wife died in 1980, he embarked on yet another career, combining computers and data-base systems with the needs of university management programs. It was during this time that he met his second wife, Linda Williams, whom he married in 1982.

Even then, Sheetz was not finished reinventing himself. As a child, he had learned a few tricks from his uncle, an amateur magician; in 1985 he decided to go professional, taking the stage name of Ace Tabularius. Although his gigs included entertaining dignitaries during the visit of the Tall Ships to Boston in 1992, he also loved to perform his magic for crowds in the street.

His skill with cards, cups, balls, and disappearing wands won him an invitation to the famed Buskerfest in Halifax, Nova Scotia, which was the occasion for another delightful Sheetz tale. While he was there, a reporter asked where he learned magic. Expecting the reporter to have read the *Deptford Trilogy*, a series of novels by University of Toronto's Robertson Davies, Sheetz replied that his mentor was the great Canadian magician Magnus Eisengrim, a character in the trilogy. Sheetz was astonished to find later that what he meant as an amusing remark was reported in the press as a fact, and he wrote an apology to the Canadian author. Davies knew a high compliment when he received one, and sent Sheetz an affidavit affirming that he had been Eisengrim's right-hand man from 1950 to 1957.

A collector of MIT memorabilia, an avid sailor who cruised extensively from the Chesapeake Bay to Halifax, Sheetz tried out one last career while suffering from the illness that would prove fatal: editor of the 50th Reunion book for his class. It was a labor of love and a publication of impressive quality. The last public performance of the protean Ace Tabularious was for the children of MIT grads at Reunions, '92. □



Calvin Dunwoody,'43, the oldest man ever to make this climb, is pictured atop Mount McKinley in Alaska, in the summer of 1991. "My goal is to climb the high point in every state to keep me out of mischief!" says the 71-year-old. Starting with the most challenging mountains first and working his way to the smaller peaks, he is well on his way. Two summers ago he climbed Mt. Rainier in Washington state and only four days later was in Chicago competing in the Triathalon-Federation National Championship. He won the title in his age range.

All this activity hasn't been without mishap. Around five years ago, while climbing in Glacier National Park, Dunwoody slipped while trying to pick up his canteen. He fell into a stream and went down a waterfall. He likens the experience to being flushed down a toilet. He permanently lost five teeth and temporarily lost his memory. In a few short hours his memory returned and he made it down the mountain. That experience taught him the importance of climbing with partners; two of his sons now complete most of his climbs with him.

43

50th Reunion

I must begin with two obituaries. A note and newspaper clipping from **Stan Proctor** report the passing of **Eugene H. Morrison** (Course II) last August, in Middletown, N.Y. Space limitations prevent my repeating all the interesting details about Gene's life that appeared in the news article. He was a native of Middletown, the youngest of five children in a prominent family of the area. After graduation from MIT he joined the Army Corps of Engineers and stayed in the Reserve for several years. Following World War II he worked briefly with Texaco in Norfolk, Va., as a terminal engineer, then returned to Middletown to enter the family business, Orange County Trust Co. Starting as assistant trust officer, he progressed through the ranks to become board chairman in 1970. He would have retired September 1. Gene and his family have been active in the civic affairs of Middletown for several generations, with particular interest in the local hospital and community college. Gene also served as a director of the Federal Reserve Bank of New York, New York State Banking Board and the American Bankers Association. We extend our condolences to his wife, Clifford, and to the other members of his family.

An anonymous card from New Haven brought news of the death of **Robert E. Jorgensen** (Course VI) in Hartford, October 19. Robert was born in Weymouth, Mass., and had lived in Granby, Conn., for the past 45 years. Following World War II service as a Navy lieutenant in the Pacific Theater, he joined Pratt & Whitney Aircraft in East Hartford as an electrical engineer. He retired in 1981 after 35 years of employment. He is survived by his wife, Constance, and numerous family members. We grieve with them for a departed classmate.

One casualty of the December Class Notes hiatus was a June note and brochure from **Gus Root** (Course II) in Falmouth, Me. On the cover of the brochure are a photo of Gus and the legend "Vote for Gus Root, Engineer/Psychologist, for Town Council. Professional competence for intelligent decisions." Inside is the story of Gus and his wife, Jane, who now live off Blackstrap Road in West Falmouth, in a home they built with their own hands. In 1946 Gus was back from World War II service as an engineer in the Army Air Corps, and working for GE in Schenectady. Searching for affordable housing in the postwar boom, Gus and other GE engineers formed a group to build a cooperative community called West Hill. For their own home in West Hill, Gus did the engineering and Jane did most of the construction. After 10 years, however, they left with their six children to attend Syracuse University and begin new careers. Jane got a PhD in reading education and became a nationally-known consultant. Gus taught engineering while earning a doctorate in psychology. After 15 years of this, they moved again, to Vermont, where Jane taught in a small state college while Gus travelled the world. In 1982 they retired to a small-scale West Hill style development in West Falmouth, where they have remained active community builders. On June 9 Gus was elected to the Falmouth Town Council. He calls this his last adventure.

West Falmouth is just a clam's throw from Prout's Neck, so Gus plans to attend the Reunion. Get the full story from him then.—**Bob Rorschach**, secretary, 2544 S. Norfolk, Tulsa, OK 74114-2624

44

Congratulations to our class president, **Ed Eaton**, who received the Bronze Beaver at the Alumni/ae Leadership Conference on September 19. The Bronze Beaver is given in recognition of distinguished service to the Alumni/ae Association and /or the Institute and is the highest honor the association can bestow upon any of its members.

In 1988, **Bob Meyerhoff** created a program to give extensive financial assistance and academic guidance to academically exceptional black students committed to studying science in college. After its first year, when it was solely financed by a grant from the Robert and Jane Meyerhoff Foundation, it drew national attention and financial contributions from NASA, AT&T, National Science Foundation, and Apple Computer. Of 71 students who have begun the program, only 1 has dropped out, and that student changed to a non-science major at the college. Their cumulative grade point average is 3.4 out of a possible 4.0., Bob, who with his wife has given more than $1 million to the program, says that "it has been extremely gratifying." We are proud to count Bob and Ed among the members of '44.

Larry Biedenharn has retired from his duties as professor of physics at Duke University and also has ceased his weekly commute to Texas to teach a class at the University of Texas.

We have two deaths to report. . . . **William Engelmann** died in June 1992. We extend our sympathy to his widow, Roma, who continues to live in Plymouth, N.Y. . . . **John H. Adams** died in September 1992 in Schenectady, N.Y. For the past 30 years, he was a mechanical engineer for the General Electric Co. at its Knolls Atomic Power Laboratories. During World War II and the Korean War, he served as a commander in the Naval Reserves. He was a member of the Saratoga Lake Sailing Club and the 46 Peak 4,000 Feet Hiking Club in New Hampshire. His wife, Betty, died in 1960. We extend our sympathy to his daughter, Christine Dewey of Gloucester, Mass., and to his two sons, Stephen and James of Glenville, N.Y.—Co-secretaries: **Andrew Corry**, P.O. Box 310, West Hyannisport, MA 02672; **Louis Demarkles**, 77 Circuit Ave., Hyannis, MA 02601

45

Christmas and New Year's will have come and gone by the time you receive these notes; yet as I pen them, we anxiously await the election results later today.

The *New York Times* of Sunday, August 30, 1992, had an article captioned "The Vanderbilts Come Marching In," which reported on a dinner dance of August 22 at the "Breakers," the family cottage in Newport, R.I. The article included a great photo of **Paddy** and **Jeptha Wade** stating, "A clearly delighted Emily Vanderbilt Wade makes her entrance into the Grand Hall with her husband, Jeptha H. Wade." I might add that the Wades made a happy, youthful couple.

Several deaths to report: **John C. O'Shea**, 12 Drum Hill Rd., Summit, N.J., on March 11, 1992. . . . **L. Robert Gardner**, age 74, on September 8, 1992, at the University of Utah Hospital. Bob graduated with an SB in architecture and returned to his home town of Cedar City, Utah, to practice; for many years Bob was the only architect in southern Utah. He designed buildings on the Southern Utah University campus as well as numerous schools, commercial buildings, and residences in the area. Bob, who was married for 50 years, is survived by his wife, Genevieve, three sons, and two daughters.

Frank J. Huddleston, 12103 Whitehall Dr., Bowie, MD, died April 8, 1992. His wife, Margaret, survives. . . . **Donald P. Strang** of Cape May, N.J., and Putnam, N.Y., died October 15, 1992, in Cape May. Don, Course VI, was an electrical engineer at General Electric for 32 years before retiring. Subsequently he was manager of engineering for McGraw Edison in Zanesville, Ohio. Survivors in-

clude his wife, Elizabeth, two sons, and a grandson.

On a brighter note, we received a delightful letter from **Ed Stoltz** of Englewood, Colo., and Tempe, Ariz., in response to a class note plea for news. To quote in part: "Re 1995 Reunion—anyplace but Cape Cod; we have had it with good ole rainy Cape Cod. Don't you Northeasterners ever go anywhere else? Why not the Greenbriar? Of course the sailors won't have a pond, but life is more than sailboats for many of us." Ed and Elinor continue to golf wherever and enjoy retirement. Thank you for a humorous, enlightening letter; I only wish we received more.

On a more serious note, we continue to wrestle with 50th Reunion plans as June 1995 will be upon us before we know it. Yes, we'll be in Boston/Cambridge for two or three days, but we week your input as to a New England spot for three days as well. Stoltz is not alone when one thinks about rainy Cape Cod.—**Clinton H. Springer**, secretary, P.O. Box 288, New Castle, NH 03854

46

For lack of current news at this late point in November right before the big election (I wonder if **Ned Tebbetts** got elected), I called my hiking buddy, **Dave Longmire** (who lives across town in Littleton, Colo.), to ask if he had any news of classmates he's kept track of. Sure enough, he sent me a list of friends with whom I'm unfamiliar.

In alphabetical order, we find **Richard Ballman** of Course X, chemical engineering, living in Gulf Breeze, Fla. . . . **Edwin T. Bean**, a V12'er and Course VI'er emanating from East Aurora, N.Y., now lives in Orchard Park, N.Y. . . . **William Bursnall**, not listed in our yearbook or our current listing, was, according to Dave, a V12/XVIer. We do know that he lives in Palm Harbor, Fla., so I'll get in touch with him. **William Lang** lives in Poughkeepsie, N.Y.

We do have **Keith Lanneau**'s picture in the yearbook. He came to Tech from Natchez, Miss., to join the V12'ers (just a lad two days younger than me—12/21/25). He's listed as an VIII physicist and is a president of Helix International Corp., Inc., in Baton Rouge. . . . Then there is **Donald Robinson**, who was mentioned a while ago as a good friend of **Don Burke**. They both live in St. Petersburg, Fla., where Don R. was brought up. He was yet another aeronautic, but his recent pursuit has been photography along with some distinguished service.

Next I'm looking at another V12er, **Bob Taylor** (12/22/25), who became a lifetime XIII oceaneer in the Newport News Shipbuilding Co., near his home and not far from where he grew up in Wilmington, N.C. . . . The Reverend **Jim Todd**, who came out of Vicksburg, Miss., joined us in the XV management course and evidently stayed with it (his career reads "President—Management Consulting Services"). He's been living for some years in Westport, Conn. I'll have to find out the specifics on the "Reverend" moniker.

The final name given to me by Dave Longmire is **Heine Trutmann**, who got a degree in the chemistry world, and from what I can tell he must have done quite well. He retired while holding on to a Shell refinery in Australia and a home in Switzerland. Hardly shabby we would guess. . . . That's the best I can offer, but I plan to contact all these fellows and get more details. I'll send each of them a copy of this tome for them to elaborate so I can give you a bigger picture. Thanks a bunch to Dave L.!

Read M. Kuhns, West Hartford, Conn., died September 14, 1992. Read had lived in West Hartford for 36 years and was employed by United Technologies Corp. for over 30 years, retiring in 1986. Besides his wife, Patricia, Read is survived by three sons (all in the Hartford area), a daughter in Greensboro, N.C., as well as seven grandchildren.

Enjoy whatever holidays are coming up. Wish you were here.—**Jim Ray**, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

47

Ann and I spent most of October driving around Scotland and Ireland, including Northern Ireland. We spent a week in the Scottish Highlands and two weeks in Ireland. Highlights were the beautiful coast of County Donegal, the Ring of Kerry and Dingle Peninsula and County Kerry, and (mostly for Ann!) a visit to Waterford Crystal. Northern Ireland was most interesting—and worth visiting. Contrary to some press reports, it is not dangerous for tourists. It is eerie, however, to see people going about their business in Belfast just as in any other big city juxtaposed with the occasional British armored personnel carrier and/or British troops in full combat gear at random locations. Our perception was that most Irish, whether in the North or the Republic, could easily compromise on a settlement of "the troubles," but the extremists on both sides continue to block any compromise. We also found that the Irish are delightful—they are very hospitable and helpful to tourists. If you get a chance, visit them and their pretty country.

We received word that **Keith Knutzen** died in October 1991. His home was Bronxville, N.Y. That's all we know. . . . And that's all this month! We need news. We were able to fill our last few columns with news gleaned at our 45th Reunion. Now let's hear from classmates who were *not* at the reunion!—**R.E. "Bob" McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

48 45th Reunion

In 1991, MIT appointed Merhan Kardar to the Class of 1948 Career Development Professorship for two years. Merhan wrote a letter of appreciation to our class for this support. The past two years were important to his career development culminating with his being awarded tenure in the spring of 1992.

Merhan has been teaching a two-semester graduate course on statistical mechanics in the Department of Physics. The course, attended by the majority of the graduate students in the department, has also attracted students from other departments. One frequent complaint has been the lack of a text for the students to consult. This is partly because Merhan developed his own exposition of the subject, and partly due to the novelty of the topics. After deciding that expanding his lecture notes and handing them out to class would partly remedy the deficiency, he used funds from the Class of 1948 grant to purchase a NeXT computer. This machine was convenient for algebraic manipulation (Mathematica) programs. Additionally it is a powerful computing machine. While he prepares his class notes, programs written by his students run in the background.

The approach was very successful. The notes are popular with the class, and he has more students than ever before. He was awarded the Department of Physics' annnual teaching award (Buechner prize) for this course. He hopes to convert the notes to a book on statistical mechanics. This task has been made easier by the funds from the Class of 1948 Chair, as Merhan relies on the computer for everything from editing to computing.

It is difficult to justify travel expenses (especially overseas travel) on regular research grants. The less restricted funds from the Class of 1948 Professorship allowed Merhan and his graduate students to participate in a number of important seminars and workshops. One student presented a poster on his work at a meeting in Berlin, another attended a two-week course on field theory techniques at the Institute for Theoretical Physics in Trieste. His third student participated in a workshop in Santa Barbara, Calif. These meetings are important to the development of students, at a formative stage of their careers.

Merhan closed his letter with a memory of joining our classmates for a luncheon on Technology Day in 1991. He appreciates the opportunities provided to him for the past two years by the generosity of our classmates. He said, "I will always feel a bond of gratitude."

Milton Slade, chair of our 45th Reunion, held a reunion committee meeting. The meeting was attended by **Harold Ottobrini**, **Sonny Monosson**, **Don Noble**, **Herb Lipsen**, **George Clifford**, Eliza Dame of the Alumni/ae Office, and yours truly.

Milt sent a mailing to all members of our class in September and is planning a second mailing that should arrive in January. He had many responses to the first mailing showing interest in the Nantucket and Cambridge campus plans he described in the mailing. We plan to go to the Nantucket Inn on Nantucket on May 31, June 1 and 2, 1993, before coming to Cambridge for Tech Night at the Pops and Technology Day (June 4). The committee will organize a historic walking tour of the Nantucket homes built by the whaling captains in the early 1800s. In addition a speaker will be invited our hotel to provide background information and places to visit during the day.

Facilities for tennis, golf, fishing, and other sports are available. We will ask classmates to arrange round robins or other suitable competition. Awards will be presented to the winners. Travel plans were discussed. Classmates driving from other places will probably drive directly to the ferry parking areas. Flights are available and prices are competitive with the ferry prices, but flights are subject to delays due to fog. On the island personal cars are not necessary, which is fortunate due to the complexity of reserving automobile space on the ferry. For classmates in Boston, a bus will available to go to the Cape on Monday, May 31, and return on Thursday, June 3. Thursday night, a pre-Pops buffet for our class is planned.

Friday's Technology Day program is being planned by the Department of Ocean Engineering, which is celebrating its 100th anniversary in 1993. The department's activities include off-shore drilling rigs, deep water submersibles, ocean exploration, and design of racing sailboats for the America's Cup. Bill Koch, '62, winner of the America's Cup, has agreed to speak. We will end the Reunion with a Class Meeting and dinner on Friday night.

Jack Juechter and his wife, Jeanne, took a walking tour of the Lakes District in England. Jack sold his consulting business. He is still involved in trials and depositions related to cases the insurance industry had given him before he sold the business. . . . **Dan Fink** writes that in addition to his consulting business, he is still doing frequent pro bono work for the government. He chairs a committee for the vice-president's Space Policy Advisory Board on the Space Industrial Base. The committee is questioning whether we are losing critical competency and what can be done about it. Dan hopes the results are useful to Clinton's appointees.

Aldo Fioravanti is fully retired and loving it. He and his wife, Anne, are doing a lot of traveling. They spend equal time at their homes in Florida and Rochester, N.Y. He is active with Barber Shop quartets, ASHRAE, and Rotary. He thanks the Lord for his good health, many friends, and for the privilege of having attended MIT. They love their four children who have blessed them with seven grandchildren. . . . **Art Fowle** and his wife, Mary, divide their time between his consulting business, their house and gardens in Brewster on Cape Cod, world travel, and expanding family including six married offspring and nine grandchildren—all living close by in the Northeast. . . . **Henry Gilbert** retired to Juno Beach, Fla., in 1976. He studied at the Norton Gallery School of Art for seven years. He sculpts in stone and wood for his own uses.

Bill Hosley retired from Eastman Kodak in 1986 after 35 years. He publishes an investment advisory newsletter, wrote software sold by Village Software, authored a glossary of 800 business words and definitions that is being translated into Russian and Georgian, wrote a book on local history and serves on two boards of directors in the health care area. He is a frequent boater, skier, and tennis player. He and his wife, Cynthia, take four distant trips each year.

Robert Manz died in August. He and his wife, Is-

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abella, had been living in Peterborough, N.H., for the past nine years. They lived in Media, Pa., for many years when he was president of Manz Printers and Publishers. On behalf of our classmates I extend our sympathy to Bob's wife, Isabella, and her family.—**Marty Billett**, secretary and president, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

49

According to the *Rutland* (Vt.) *Herald*, **Davis B. Keniston**, 70, of Perkinsville, Vt., died August 24 after a three-month illness. Davis was a mechanical engineer whose career included service at Dennison Manufacturing in Framingham, Mass., then at four companies all in Vermont—Liquidometer in Rockingham, Gratiot Engineering in South Pomfret, Bryant Chucking Grinding in Springfield, and Jones and Lamson, also in Springfield.

Davis served on the Weathersfield (Vt.) Planning Commission for 20 years (13 as chair) and was chair of the Southern Windsor (Vt.) County Regional Planning Commission. He was a trustee of Perkinsville Community Church for 19 years and was active in the financial planning of the church. Survivors include his wife of 45 years, Patricia; a daughter, Susan; and three sons, Davis IV, Matthew, and John Peter. He also leaves cousins and three grandchildren.

The *Connecticut Post* of Bridgeport, Conn., reports that **Arthur C.E. Loven**, 71, died suddenly at the Leonard Morse Hospital in Natick, Mass., August 29, 1992. During World War II, he served with the Army as a sergeant major in the Military Government in the German Occupation Forces. He worked with the Timex Co. in Scotland and then with Harvard Apparatus Co. in Millis, Mass., until his retirement in 1976. A 30-year resident of Needham, Mass., he was a member of the Presbyterian Church of Needham and the Highland Glee Club, and was a volunteer at the Glover Memorial Hospital in Needham for seven years. Mr. Loven, husband of the late Elizabeth (Dow) Loven, is survived by a dear friend, Mildred Chydzik; his children, Ann Loven, Charles, Joanne Basham, and Peter; a brother, Otto; and five grandchildren. He was buried in Needham Cemetary on September 2 after a service at the Presbyterian Church in Needham.

The Class of 1949 shares in the sadness of the families at the passing of these two men.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

50

Charles Herbert writes that he is working on interesting problems in workstation software, QA. His daughter, Barbara, has just graduated from the University of Colorado, Boulder, and his son, Fritz, is starting at the University of California, Santa Barbara. Charles remains active in the national ski patrol and the MIT Educational Council. . . . Professor **John H. Holland** is the recipient of a five-year award from the MacArthur Foundation for the period 1992-1997. This fellowship of $360,000 will enable him to keep up his research activities.

Hank Sharp reports that his latest travels have taken him to Russia and the Ukraine. While there he traveled extensively on the subway and was impressed with the incredibly efficient systems; he also was happy with the bed and breakfast accomodations. Hank mentioned a recent visit to **Bob Boyden** and his wife, Dixie. Bob is a gourmet cook, and Hank was an appreciative recipient of all his offerings. Hank is again entering the Boulder Mountain cross-country ski race in February and repeats his earlier invitation to have others join him. . . . **Jack Willard** writes that an MIT education comes in handy everywhere—one of his retirement pursuits is in the clock business and he particularly enjoys repairing antique clocks.

I received an interesting letter from **Sam Raymond** telling about the successes his company has had with research vehicles built for locating and photographing deep underwater sunken vessels. His company participated in the discovery of the *Titanic* and Sam went on the fourth expedition to the site. Sam was designated as "Explorer of the Year" by the MIT Club of Boston. However, the most interesting part of his letter concerned his experience with bungee jumping in Sweden, a sport that I'm sure has not attracted many class members. Sam's poetic description of the event is too long to reproduce here, but write to him at Benthos, Inc., N. Falmouth, MA 02556 for a copy. You'll love it! Also, if you've done bungee jumping, Sam would like to hear your reaction.

Jordan Loftus was named one of the five charter Texaco fellows in February 1992. The title is in recognition of outstanding personal and corporate accomplishments within Texaco and the petroleum industry. Jordan is currently chief consultant of the Texaco Engineering Division-Houston. He has completed 11 years as chair of the American Flame Research Committee, a National Committee of the International Flame Research Foundation. Jordan and his wife, Bernice, have children in Atlanta, Cincinnati, and Houston, and have five grandchildren.

The following members of the class have passed away. . . . In May 1992, **Donald P. Germeraad** of Underwood, Wash., an aero graduate who was a Navy pilot in World War II. After graduation he became a test pilot for General Dynamics for 22 years, and for 17 years after that he worked for Lockheed's inner space program. Don retired about eight years ago to his mountain home above Underwood, and at the time of his death he was chair of the board of deacons of the Bethel Congregational Church. . . . **Frederick Griebel** died in August 1992 at his home in Lynnfield, Mass. A resident of Lynnfield since 1955, Fred was a mechanical engineer with EG&G Dynatrend for the past 18 years.

In a note from Bob Mann, I heard more about the sudden passing of **Richard (Dick) Henderson**, my thesis partner in chemical engineering. Dick died after heart surgery in New Jersey. At the time of his death, he was employed by Thomas Lipton Co. in Englewood Cliffs, N.J., as manager of Process Development. Both Bob and I remember Dick as an articulate, gregarious friend, very active in class affairs during our undergraduate days, and a regular, enthusiastic participant in class reunions and other activities. He was a skilled photographer, chronicling many class activities, our very popular mug lifts, dormitory life, the demised freshman/sophomore glove fight, intramural athletics, etc. As a photographer, he made many valuable contributions to our yearbook, the *Technique*. He is survived by his wife, Patricia (Pat), who always accompanied Dick to class functions. Pat has graciously made arrangements for Dick's collection of class photos to be reviewed by Phil Byrne for eventual use in class activities.

You have increased your news for me lately; please keep it up. Thank you.—**John T. McKenna**, secretary, P.O. Box 376, Cummaquid, MA 02637

51

Just prior to our 40th Reunion, our class established the "Class of 1951 Fund for Excellence in Education." The purpose of the fund was to be directed towards a means of enhancing and enriching the undergraduate educational experience at MIT. Our classmates pledged about $750,000 to this fund. Almost half of this amount has already been received. **Harold Glenzel**, our class president, has set up a committee to provide some direction for the use of this fund. This committee in addition to Harold includes **Bill Maini, Marv Grossman, Fred Ezekiel, Chuck Hieken, Mike Lecar**, and **Marty Greenfield**. The group has been meeting and is attempting to establish an initial usage for the fund by the end of this year. They

most recently met with Art Smith, the dean of Undergraduate Education and Student Affairs. Initially there was sentiment towards establishing some monetary award to be given to those who excelled in the cause of undergraduate education. More recently the group has been leaning toward providing funding for projects that would enhance the undergraduate education experience. We will try to keep you informed of how this unfolds. The committee would be receptive toward any of your thoughts. Send them to me, and I will see that they are considered by the committee.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

52

Last summer **Herbert H. Dow** retired as VP and member of the board of directors of Dow Chemical. He had earlier retired as corporate secretary.

I noticed in a printout of class members sent to me by the Alumni/ae Association that **Art Turner** is listed as retired from Baird Corp., where he has worked for about 35 years. At our reunion last June he mentioned he was considering retirement, and apparently his consideration was favorable. Art and Sally have one son in graduate school at RPI, and another who is a freshman at University of Vermont.

You may have noticed that the Alumni/ae Association is soliciting e-mail addresses for alums, and *Technology Review* is encouraging class secretaries to send their copy for class notes by e-mail, too. My e-mail address is listed below and I would be delighted if any of you who use e-mail would send me a message. I would like to have your e-mail addresses, too, and of course I am interested in any news you may have. Letters and postcards are also acceptable.—**Richard F. Lacey** , secretary, 2340 Cowper St., Palo Alto, CA 94301, e-mail: lacey@hpl.hp.com

53 40th Reunion

The class reunion will soon be upon us. As I write this in November, we have received one mailing and the responses have started to arrive. Just to prove that your notes do get read, I'll include them here. So keep on sending the notes whichever way you can.

Dave Berg, who lives in Needham, Mass., says he will attend the reunion and reports that he is still practicing engineering and will continue to do so until he gets it right. He must be doing something right because he is still in business with the firm he started 30 years ago. He has two married daughters and one granddaughter who lives only three miles away. He says he is looking forward to the 40th reunion.

Ben Coe of Watertown, N.Y., is also going to make the reunion. He continues as the executive director of the Tug Hill Commission. He has also been busy this year as president of the Jefferson County United Way. He and his wife, Peggy, have two grandchildren. He went on a trip to the Galapogoes in February 1992.

Janet and **Mort Grosser** report that Mort's seventh book, *The Fabulous Fifty*, won the Commonwealth Club award for Young Adult Fiction. Janet has been elected to the board of directors of the International Ballet Council.

George Peckar, who lives in Salt Lake City, is uncertain about being able to make the reunion. He is semi-retired, living in and loving Utah. All I can say is, "George, come on and join us." I'll take a bit from Mort's book and say that this will be the "Fabulous 40th."

Now this next one I like: someone else who had seven children. I'm not the only passionate protestant. . . . **John Rutigliano** reports from Danville, Calif., that he is currently senior VP and member of the board of directors of Bently Engineering Co. He is managing the NASA Ames Research Center Office for Bently. He first joined Bently in 1976. He formed Johnson and Rutigliano - Structural Engineers with Steve Johnson, '49, in 1981. They merged with Cygna Consulting Engineers in 1983. He formed a new consulting firm, Rutigliano Associates, in 1986 and merged with Bently in 1987. In addition to seven children, he and his wife, Ellie, have six grandchildren. John, I have you beat there with 10 grandchildren, at last count. John says that he enjoys flying, once having owned his own plane. John, I'm looking forward to seeing you at the reunion.

I also received an announcement from the Florida State University that Nobel Laureate, **J. Robert Schrieffer**, a physicist with the National High Magnetic Field Laboratory at Florida State University, was the featured speaker at their summer commencement in August. Robert won his Nobel Prize in 1972 for his work as co-author of the first theory of superconductivity, explaining the phenomenon of zero electrical resistance in certain materials, particularly at low temperatures. He is a tenured professor of physics at Florida State University and also teaches at Florida's seven other public universities as the state's first University Professor.

And finally, the sad part of my job. A number of our classmates have died recently. **Christopher Whitcombe** of Newark, Del., died of cancer in July 1992. **Howard Wong** of Silver Spring, Md., died in August 1990. **Bernard Edelman** of La Mesa, Calif., died in June 1992. And **James Flanders** of Cambridge, Mass., died of pneumonia in August 1992.

Keep the news items coming.

Late news item. **Marty Wohl**, our class president, asked me to include the following regarding the reunion and other activities. Marty reports that **Dave Berg** has agreed to serve as reunion co-chair with Marty. In addition, **Dick Lindstrom** will serve as a liaison between MIT and other reunion committee members who reside outside the Boston area. **Dick Simmons** will serve as Reunion Gift Chairman and **Fred Brecher** will co-chair the effort to prepare a 40th Reunion Yearbook. Marty asked that I also report that **Dick Linde**, treasurer, and **Gil Gardner**, secretary, continue to provide "invaluable" assistance. On the other hand, we need additional help with the reunion activities to lighten the load on our volunteers.

We are investigating the wisdom of publishing a reunion yearbook for the class of 1953. The Institute is willing to provide both financial and staff assistance for its preparation. Your opinions would be welcome and Fred Brecher would appreciate any help you can provide on this project. Drop me a line either way and your assistance will be greatly appreciated.

And finally, the subject of electing class officers for the next five years keeps coming up. We are currently planning on something a little different this time. Anyone in the class will be allowed to nominate himself or some other member (with his or her permission). Nominations should be forwarded to me, Gil Gardner, at the address below, prior to May 1, 1993. Ballots will be prepared for delivery to attendees at the reunion on the first day of registration. Anyone paying class dues may vote by absentee ballot. Call me early in May and I'll send you a ballot that you can return to me before the reunion. The results of the election will be announced at one of the dinners planned for Friday or Saturday night. If anyone has other suggestions regarding the process, please give me a call or drop me a note. The process is not yet set in concrete. Marty says that if H. Ross Perot wishes to *first* donate $1 million (in cash or certified check), Mary would make him an honorary member of the class and allow him to nominate himself for any office he desires. I hope you recognize that the presidential election is over as I write these notes.

Remember that the reunion is only a couple of months in the future and you should be making your plans by now and making commitments to come. A great time will be had by all.—**Gilbert D. Gardner**, secretary, 1200 Trinity Dr., Alexandria, VA 22314, (703) 461-0331

54

A welcome letter from our illustrious class president, **Joe Blake**, informs us that he and his wife, Eileen, now have 10 grandchildren, with numbers 11 and 12 due by sometime this spring. Joe says that he feels very old. He and Eileen spent three weeks in Italy and France in the early fall, working their way through the various wines of the area. In the meantime, however, plans for our 40th Reunion in 1994 are under way. *All* of us should be planning now to return to MIT for the reunion, and to return to MIT some compensation for the gifts we all received while studying for our degrees there. Please also think about sending me the latest news on your activities in order to keep everyone informed. If it's easier to scribble and fax, send your notes to me at fax # (203) 576-4983.—**Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Lane, Fairfield, CT 06430

55

Please send news for this column to: Co-secretaries: **Roy M. Salzman**, 4715 Franklin St., Bethesda, MD 20814; **James H. Eacker**, 3619 Folly Quarter Rd., Ellicott City, MD 21042

56

John E. Sirmalis of Barrington, R.I., has been named executive director of the Naval Undersea Warfare Center (NUWC) Division, Newport, R.I. John now holds the senior civilian position at the command and is responsible to the commander of the NUWC Division, Newport, for the technical program, its planning, conduct, and staffing. He also acts for the commander on all matters in the application of science, engineering, and technology to achieve the technical program of the command. Its mission is to provide research, development, test and evaluation, engineering and fleet support for submarines, autonomous underwater systems, and undersea offensive and defensive weapon systems and countermeasures associated with undersea warfare. John is the recipient of several significant Navy awards. These include six Senior Executive Service awards for performance. He also received the Presidential Rank Award of Meritorious Executive in 1984, and the Department of the Navy Superior Civilian Service Award in 1989. John earned SB and SM degrees at the Institute and a doctorate in mechanical engineering from the University of Rhode Island.



John Sirmalis

I talked with **Bill Grinker**, a member of our Class of '56 board of directors, at our recent Brookline High School 40th Reunion. Bill is the president of the American Computer Group, Inc., in Boston. He has written articles for publications in the computer leasing field and is the past president of the Computer Dealers and Lessors organization. Bill and Ilene have travelled extensively including trips to Indonesia this year; Ecuador, the Galapagos, and Turkey last year; Australia, New Zealand, and Papua New Guinea in 1990; India in 1989; China in 1988; Russia in 1987; Kenya in 1986; and Israel and Egypt in 1985.

As your co-secretary, I would like to report some happy news from the home front. My older daughter, Laura, a graduate of Harvard College and NYU Law School, has announced her engagement to Ethan Brecher of Greenwich, Conn., who is also a graduate of NYU Law School. Both graduates are with law firms in New York City. My younger

daughter, Susanne, also a Harvard College graduate, is with Decision Resources in Burlington, Mass., where she is a research associate in economics. My wife, Marcia, is the owner of a very fine antique shop, Marcia & Bea Antiques. I am in project management in the Physical Plant Engineering Group at MIT Lincoln Laboratory. Send news to: **Ralph A. Kohl**, co-secretary, 54 Bound Brook Rd., Newton, MA 02161

57

Once again the mail has been very light this month. Those of us living in the greater Boston area run into each other from time to time, and news about the Institute is a fairly regular feature of the local press. However, we would all like to hear from the rest of you. Please write.

Your secretary and **Julian Cherubini** fine ourselves attending some of the same fund-raising functions. We also both have children in the arts: his daughter is a potter and my son a commercial photographer. A regular topic of conversation is the difficulty of making a living in those fields in this economy. It makes engineering seem simple.—**John T. Christian**, secretary, 23 Fredana Rd., Waban, MA 02168

58 35th Reunion

Our 35th Reunion at the Black Point Inn looks to be one of our best, so mark June 3–6 on your calendar for a long and wonderful weekend! Located on Prouts Neck, Maine, close to Portland, the Inn offers a tremendous variety of activities for everyone. Sports and fitness enthusiasts can opt for golf, tennis, biking, sailing, swimming, or walking and beachcombing. Shop-aholics can browse in the quaint shops of the Old Port District or hop up to L.L. Bean and other outlets just north of Portland. Gourmets will love the food. It's all happening just a few months from now, so do three things: (1) Send in your class dues of $19.58 now to help cover mailing costs; (2) Fill out and return the Class Questionnaire; and (3) Make your reservations as soon as you receive the forms. That's all there is to it!

Turning to other news, **Freeman Shepherd** received the 1992 Harry Diamond Memorial Award from the IEEE. He was recognized for work on developing platinum silicide focal planes for infrared sensing. The Diamond award is given to top technical contributors in government service. Freeman is a senior scientist at Rome Laboratory's Directorate of Electromagnetics and Reliability at Hanscom AFB.

Pete Hellsten is "retired" but still actively consulting. Pete writes that "I'm racing pro outboards on almost a full time basis." (Some retirement!)

In talking with **Bob Jordan** recently, he had just learned of the death of **Walt Wiechman**, a fraternity brother and classmate. Although trained as a chemical engineer, Walt learned to fly a small plane, got hooked, and signed up to become a pilot with Northwest Airlines. For the last 15 years, Walt was in the pilot's seat. Classmates will recall that Walt rowed with the varsity heavyweight crew at Tech.

Not to be outdone by the summer '92 Olympics, **Tom Magliozzi**, the host of NPR's "Car Talk," threw the "Games of Ancient Grease" at MIT. Events included the 200 meter McPherson Strut and the Horn Relay Race, among others. . . . Clearly, this was a "tune-up" for the 35th Reunion events.—**Mike Brose**, secretary, 75 Swarthmore St., Hamden, CT 06517

59

First, a slightly belated (only by a couple of years) but important note from our 30th Reunion on the Cape (well attended and a great time for all!). Class Officers were elected, and are: **Dave Packer**, president; **Chuck Staples**, treasurer; **Al Bufferd**, secretary, **Bruce Blomstom**, class agent, and **Jack Fischer**, 35th Reunion chair. In addition, we selected vice-presidents to cover the world: **Al Kniazzeh**, Boston; **Adul Pinsuvana**, Far East; **Marty Zimmerman**, Midwest; **Ed Vrablic**, New England; **John McElroy**, New York; **Larry Boyd**, Pacific Northwest; **Pedro Garcia Nicoletti**, South America; and **Bob Muh**, West Coast. Congratulations to all!

Looking to the future, **Jack Fisher** reports: "Our 35th Class Reunion planning is well underway. Early this summer we held our initial organizational meet at the Faculty Club. Among those in attendance were Margaret and **Jack Fischer**, **Chuck Staples**, **Larry Bishoff**, Carol and **Ed Vrablick**, **Al Kniazzeh**, Sheila and **Bill Widnall**, Mary and **Glen Zeiders**, and Ginny and **Dave Packer**. The primary effort was to identify potential sites for our next gathering to be held in June 1994. (Mark your calendars!) Among places being considered are the Wequasset Inn and Chatham Bars on Cape Cod, the Black Point Inn at Prouts Neck, Maine, and the Red Lion Inn in Stockbridge, Mass. We are anxious to welcome new faces to our planning group and if you would like to help out in any capacity, contact me at (617) 581-5515.

"In one special area, our reunion meeting produced truly exceptional results. Two members in attendance that evening have recently married. Mary and **Glen Zeiders** were wed in August and are residing in Peabody, Mass.; and **Larry Bishoff** and Ann Wiggens were married on October. Larry and Ann first met at the Institute where they were both in MIT's Medical Department for a number of years. After a wedding trip to Hawaii, the Bishoffs reside in Newton. Please come to our next meeting. You never know what might result!

On a more personal note, Jack notes that "since April, I have been consulting with Copley Corp. in Westwood, Mass. Copley was founded nearly 10 years ago by fellow MIT alum Matt Lorber, '57, who together with Ray Stata previously founded Analog Devices, now a Fortune 500 company. Copley manufactures power amplifiers widely used in the motion control industry in robotics and factory automation and also provides gradient drives for several important manufacturers of MRI (magnetic resonance imaging) equipment both here and abroad. It has been especially enjoyable while at Copley to become re-acquainted with classmate **Clarence Peter Zicko** who also worked with Matt at Analog and now is a key member of the Copley team as chief engineer."

Bob Muh, now president of the MIT Alumni/ae Association, chaired the annual Alumni/ae Conference, including an excellent Saturday session in September, which **Jack Fischer** and I attended. . . . Congratulations to **Paul Ekberg**, recently appointed the the Board of Directors of Birmingham Steel Corp.

A note from **Ron Stone** provides a good update, as follows. "The last reunion in 1989, which I could not attend, found me finishing up a stint as director of corporate development at Cornell University in Ithaca. The corporate fund raising assignment had been loads of fun and very successful. But I was anxious to try something new and also, if possible, move into the 'for profit' world. And that's what I did.

"A good friend at Johns Hopkins was starting a company, Cartermill, to build a database that would include detailed records of the research facility and projects at the leading universities in North America. I signed on and for the first year or two visited over a hundred institutions from Vancouver to Athens (Ga.) convincing them to participate and share with us their research records. I'm a walking Peterson's Guide. As of now, we have about 130 universities as well as the CDC in Atlanta, NIH, etc. For the last year or so the travel, while undiminished, has involved selling research-based companies in the United States and Canada. About 60 have been bought in and are browsing the information daily. Anyone who has the slightest doubt about the grim economy should spend a year or so selling a new, discretionary product to the research-based companies of America. Quite a kick!."

Ron continues, "On the personal side, Barbara and I celebrated our 23rd in May (Some may recall that we honeymooned as part of our 10th Reunion). Our daughter, Carolyn, graduated from high school in June. And David, age 13, is a competitive swimmer and burning up the local seventh grade. And I continue to do much of the MIT interviewing here in the shadow of Cornell."

Well, that's about it for now. After a time of sparseness in these pages, we are committed to a continuing flow of Notes in editions to come, and I actively solicit your news and your views. I know from the comments received that your items and updates will be greatly appreciated by your classmates and friends!—**Dave Packer**, president, 31 The Great Road, Bedford, MA 01730, (617)-275-4056

60

I am writing this on November 5 in Washington, D.C., and, along with many others in the ranks of the civil service, wondering "quid nunc?" While not grabbing the brass ring, one who has a Brass Rat and who entered with us in 1956, though officially a member of '62, is Andre Marrou, the Libertarian candidate for President. Andre (Vern) was on the ballot in all 50 states. His platform included elminating the federal debt by selling off government land and buildings and the legalization of drugs—he noted that Queen Victoria smoked marijuana. Perhaps we'll be hearing more from Vern come '96.

A letter from **Joe Verderber** related the thoughtful responses and success he had in replacing the Brass Rat he lost in a burglary (August/September 1992 class notes). Classmates **Dave Powell** and **Steve Halprin** called Joe and offered their rings. Joe accepted Dave's offer and now has a ring that hadn't been worn in 30 years and didn't even need resizing. Let me echo Joe's thanks to Dave and Steve for their generosity. While I haven't checked with Steve, there may be at least one other '60 Brass Rat available for a ringless classmate. . . . Joe also reports that he attended the Cape Cod mini-reunion. He says that the few '60s in attendance really enjoyed the weekend.

From Wilmette, Ill. Sheldon and Suzy (sister of deceased classmate, **Sam Latt**) Epstein sent an announcement of the engagement of their daughter Elizabeth to David Geifman. A February wedding is planned. Shel invites ham-operator classmates to call him on the 20-meter band—callsign is K9APE.

A recent issue of the *Washington Post*'s business section featured the Industrial Training Corp., whose is classmate **Gerald Kaiz**. The lengthy and highly complimentary article told of the advances ITC has made at the cutting edge of the use of interactive, multimedia technology for individual training. One sign of ITC's success is that IBM has taken the relatively small company under its wing, offering marketing support and space in IBM booths at trade shows. Continued success, Jerry.

We have another author in our midst. **Peter Brandt**, currently an architect in private practice and an instructor at the New York School of Interior Design, has written *Office Design*. Based on the principle that many people spend more time in offices than any place outside the home, his book explores the complete process of office design from initial marketing of services to project follow-up.

Barry Karger was a featured speaker at a recent meeting of the Northeastern Section of the American Chemical Society. Barry currently holds the Waters Chair in Analytical Chemistry and is director of the Barnett Institute of Chemical Analysis and Materials Science at Northeastern University. On the faculty of Northeastern since 1963, Barry has over 175 publications in the field of separation science, and has been mentor to over 50 PhD recipients. Barry has garnered many honors both in the U.S. and the U.K. during his career, among them a Sloan Fellowship and being named a fellow of the AAAS.

The *Wall Street Journal* reports that **Donald Sipos** has been named president of the Specialty Products Group of SL Industries in Camden, N.J. Best wishes in your new position, Don. . . . Among the 26,000

runners in the New York marathon was **Abe Feinberg**. Abe and his wife, Vickie, made the trip from California for the race, held on a beautiful but cool and windy day. We had a chance to chat during a pasta dinner the night before the race, but Abe "blazed" by my vantage point before I had a chance to photographically record the event for this column. Other than Abe and **Mike Kasser**, do we have any other marathoners in the class?—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

61

Please send news for this column to: **Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167

62

While classmate **Andre Marrou** did not win the 1992 Presidential election, he did get more votes from Dixville Notch, N.H., than the eventual winner, Bill Clinton. Andre ran as the Libertarian Party candidate on a platform of repealing the Federal Income Tax, abolishing the Internal Revenue Service, and downsizing the Federal Government to one tenth of its present size. I'm convinced that his program would have done more to balance the federal budget than the one proposed by Ross Perot, but I'm skeptical about the impact of such a massive change on the American economy. Andre's policies to get government regulation out of our lives and our pocketbooks had much appeal for millions of Americans, but I'm not sure his positions on abolishing public education and legalizing drugs and prostitution were as broadly endorsed. He also was not permitted to participate in the televised debates of the three major candidates, but I understand he had a dynamite debate with Lenora Fulani on C-Span on the cable networks.

Bill Koch is back in the news with his new position as chair of Kendall Square Research Corp. of Waltham, Mass. Bill continues as president and principal owner of Oxbow Corp. of West Palm Beach, Fla. . . . **Marty Klein** has sold his sonar design company but is continuing to work as a consultant in the field of underwater exploration according to an article in *The Andover Townsman*, Andover, Mass. Marty has been back to Loch Ness again and did assist in the discovery and recovery of a World War II Wellington cloth-covered bomber that is being restored for a museum in the UK. Marty serves on the advisory board of the Council of Underwater Research and while skeptical about finding the "Loch Ness Monster" he does believe the mystery can be solved. He intends to return to the Loch in 1993 to attempt to add "Nessie" or whatever it is to his discovery list that includes the *Titanic*, the *Atocha*, the *Lusitania*, the *Edinburgh*, the *DeBraak*, and many other less famous shipwrecks. He has also assisted in the Persian Gulf with techniques to locate and destroy underwater mines.

We received a nice note of gratitude from Alice Gilchrist, one of our Class of 1962 Scholars. She is a junior at MIT majoring in political science and writes news stories for *The Tech*. She wanted to thank all of the members of our class that have contributed to the scholarship program.

The e-mail system is working. I have received Class Notes feedback from **Alan Kotok**, **Chuck Niessen**, **Dave Bragdon**, and **Leland Jackson** via the MIT1962 network. Alan Kotok has just completed 30 years at Digital Equipment Corp., mostly in hardware design. He has now transitioned to the software realm, and is technical director, reporting to the VP for software engineering. Alan is presently concentrating his efforts on the area of computer systems management. He and his wife and younger daughter live in Harvard, Mass., and their two older children are away at college. . . . Chuck Niessen is still working at MIT Lincoln Laboratory. After a seven-year stint as head of the Optics Division, he recently became head of the Computer Technology Division. Chuck enjoyed the 30th Reunion, and the opportunity to visit with classmates he had not seen since the 25th. His son, Christopher, is in Course VI at MIT (Class of 1993), and Chuck has been helping with the Parents' Program, run by the MIT Alumni Office. One of the events sponsored by this program was the fall Family Weekend open house that gives parents a chance to visit the MIT campus and see how the Institute is spending their tuition and other fees. It is particularly well-attended by the parents of the Freshman Class, and helps to allay their anxieties. It also was useful to Chuck to see how the academic program has changed since our years at the 'Tute. He observes that the pressure from the fire hose is just as great and the hours just as long. He observes, "Rumors that MIT has humanized the life of the student are unfounded." At least MIT won't be criticized for lowering its expectations of academic performance or the knowledge implanted into its graduates.

Dave Bragdon writes that he is working on V1.1 of DECathena at Digital in Littleton, Mass. He indicates that there was plenty of interest at Interop in late October 1992. Dave is excited to be part of the effort to share and enhance the Project Athena technology at MIT. He mentioned that there are quite a few recent graduates of the 'Tute on the project, but they seem to be getting younger all the time. He is impressed that while they seem to get younger they are very bright and quite knowledgeable about computer technology. . . . Leland Jackson sent me greetings with e-mail addresses for **John Prussing** and **Joe Perkell**. Joe was already on the MIT1962 network , and I have now enrolled John as well. You can use the "Review MIT1962" message to find out who are enrolled on the MIT1962 network by sending the request to LISTSERV@MITVMA.MIT.EDU.

Join your classmates on MIT1962: If you have an e-mail capability and haven't done so, please subscribe to MIT1962, now operating through the courtesy of the MIT Computer Systems. You may join the network by sending the message text: SUB MIT1962 to LISTSERV@MITVMA.MIT.EDU on the Internet system. If you can't figure that out, just send a message to MIT1962@MITVMA.MIT.EDU or to HMCCARL@ENGSYS.ENG.UAB.EDU and we'll put you on the e-mail network. We would like all classmates with e-mail connections and the ability to communicate with Internet/Bitnet/Telnet, to sign up on the network. The Alumni/ae Office will be requesting your e-mail addresses and setting up a master system for all classes, but we are pioneering the effort with our own network as a trial run for the rest of the alumni/ae.

As always, even if you don't use high-tech communications, just send a note or card via the U.S. Postal Service to: **Hank McCarl**, secretary, P. O. Box 352, Birmingham, AL 35201-0352

63 30th Reunion

I am sorry to report that **Fred Hollender** of Minneapolis has died. Fred, an attorney specializing in formation and financing of small businesses, died in July 1992 at age 51 of a heart attack. A member of Phi Beta Epsilon, Fred majored in economics, and got a law degree from the University of Minnesota. He left children from two marriages—seven in all ranging from three months to the mid-twenties. His widow, Christine, (formerly a commercial loan officer) told me Fred's interests lay in the outdoors, and that he had planned to take a year off to sail around the world. He also wanted to take some time to go back to school and get an undergraduate physics degree, but events overtook him. Fred looked back with pride and pleasure at his days at MIT. He left a legacy of service to Minnesota's small business owners, and of caring to his widow and children. Christine and their younger children live at 2428 W. 22d St, Minneapolis, MN 55405-2317.

Bruce Eisenstein wrote me by e-mail (he can be reached at bruce_eisenstein@cbis.ece.drexel.edu) that he is still head of EECS at Temple University in Philadelphia. His eldest son, Toby, is a fifth year student at U. Penn in decision sciences (at Wharton School) and systems engineering. Andy is junior in political science at Penn. Lana, 15, is a sophomore at William Penn Charter School. Bruce's wife, Toby, teaches microbiology and immunology at Temple Medical School. They had a visit from **Larry Krakauer** and his wife, Margy, with daughters Elissa and Sara. Elissa was looking at colleges in Philadelphia. They were joined for dinner by **Dan Ross** and his wife, Faye, and youngest son David. The Ross' elder two sons, Kevin and Eric, are both at Yale. **Dick Males**, his wife, Barbara, and son Matthew, who live in Cincinnati, also dropped in. Dick is a consultant in water resources.

Fran Dyro read here about **Ron Jansen**'s retirement. She wrote that "...after 14 years of fighting against bureaucracy and discrimination in the VA I have decided that my blood pressure will take no more. I have decided to leave the VA and retaliate by writing a novel about the place." She has been head of clinical neurophysiology at the VA Hospital in West Roxbury. She will probably continue to teach neurology at Harvard Medical School, but will commute from Portland, Maine.

Fran is looking forward to our 30th Reunion. Me, too. When you read this you will soon be getting details of the plans being put together by president **Pete Van Aken** and his committee. Look in your mailbox. See you in June!

Here is a first: a press release of a resignation. **Tom Emerson** has left his position as president, CEO, and board member at Syntellect, Inc., of Phoenix, Ariz. I have no further information. . . . I also have a release about an appointment. **Stuart Cooper** has become dean of engineering (effective

FRIEDLAENDER

(Continued from page MIT10)

was doing, and that was probably true until the moment she died.

"If Nan said she would do something, or if there was something that the circumstances called upon her to do, she did it, come hell or high water," Solow says. "But I hope I'm not drawing a picture of a solemn person, because she was a lot of fun."

When she became ill, Friedlaender called the people with whom she worked and told them her diagnosis. Completely open, calling upon boundless inner resources, she pushed on and in so doing, put other people at ease. A colleague, knowing her illness, observed her at work and asked, "Why are you doing this? If I were you, I'd buy a Bronco and travel across the country."

"That would drive me crazy," Friedlaender answered. "This is what I'm here to do. This is what I want to do."

She was involved in research and working with colleagues on departmental decisions on Friday, and on Monday morning, she died. "She was able to work to the end," said Pauline Maier, "and that is what she wanted."—*Marjorie Lyon* □

The author, a former editor of the alumni/ae section of Technology Review, *now works as a freelance writer.*



Stuart Cooper

1/1/93) at the University of Delaware. The college of engineering has almost 400 grad students and 1,000 undergrads with over 70 faculty and substantial sponsored research. Stuart had taught at the University of Wisconsin after he got a PhD in chemical engineering from Princeton. He remained there until the recent appointment, including six years as chair of chemical engineering. Stuart also was a visiting professor at UC Berkeley, the Technion in Israel, and Universite Paris-Nord.

Upcoming book: **John Wawrzonek** and his colleague Damon Reed are putting together, for spring release, an edition of H.D. Thoreau's essay "Walking," illustrated by 50 of John's photos. They include several from Walden, taken a few feet from the famous Thoreau cabin. The publisher will be The Nature Company. Watch for it. And write me with news from you.—**Phil Marcus**, secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (410) 750-0184, CompuServe: 72047,333— Internet: 72047.333@compuserve.com.

64

The Institute honored two of our classmates during the Alumni/ae Leadership Conference held last September. **Robert Blumberg** received the Harold E. Lobdell '17 Award and **Gerald J. Burnett** received the Henry B. Kane '24 Award. The Lobdell Award is given in recognition of valuable alumni relations service to the Institute that is of special depth over a sustained period. the Kane Award is given in recognition of exceptional service and accomlishments in fundraising for the Institute. Bravo to both for their efforts in trying to make the Institute a better place!

The *Pottsville* (Pa.) *Republican* carried a story about **Jeffrey Friedberg** and his successful career switch from geophysics to investment management. Jeffrey earned an SB and SM in Course XII and then went on to CalTech. He joined Western Geophysics Co. after completing graduate work. His lifelong interestin the investment field eventually lured him away from geophysics in 1979 and helped him start his own business, Friedberg Investment Management of Houston. He now oversees the investment portfolios of 180 clients in the Houston area, with a total value of $12 million. Judging by his comments in the article, the decision to change careers has settled well.

Our faithful electronic correspondent **Bob Gray** sent along the following e-mail message from Stanford: "I was recently elected a fellow of the Institute of Mathematical Statistics. I'm teaching an undergraduate course for the first time every (in 23 years here): EE101, much like the MIT 6.01. I am co-chair of the 1993 IEEE International Symposium on Information Theory to be held in San Antonio, Tex. My wife and I were back in New England in June and July for the first birthday of our grandson Nathaniel (in Meredith, N.H.) and for visits to many Boston museums and restaurants. While in New Hampshire, I went sailing on Squam Lake (Golden Pond) with my brother Pete ('61), who was also visiting. We reminisced about our sailing together in 1961 on the MIT sailing team when it won the championship, 31-plus years ago, sigh!"

That's the news for this month! Write if you get a chance.—**Joe Kasper**, secretary, RR 2, Box 4, Norwich, VT 05055

65

Patricia Erickson reports from San Francisco that she is enjoying working full-time for one firm after a number of years consulting. She continues her interest in world music and dance, reporting that her Chinese orchestra recently opened for the Grateful Dead on Chinese New Year. At least her son, Arvid, now 22, found the process fascinating. Tricia reports she keeps in touch with **Andy Tanenbaum** regularly by e-mail and that **Whit Diffie** really is alive and well living in Mountain View, Calif. One side note on that last one—many of our classmates are "lost" in the MIT system. If you know of any, please write me and I will get the system corrected. Thanks.

Jim Kitler called to discuss his latest changes. Jim is now at Union Trust in Connecticut managing their investments area—a far cry from his early work at General Electric. He reports being quite active in the Connecticut Down Syndrome Congress, an interest driven by his younger child, age 6, who has the disease and is able to start kindergarten this year as normal. His other child is in fourth grade. Jim reports keeping in touch with **Richard Homonoff** at Liberty Mutual.

Barbara Shortt reports mainaining residences in both New York and Paris as she continues to focus on architectural journalism and move away from being an active practicing architect. Barbara got her architecture degree with our class after graduating from Radcliffe. She focuses her writing on interpreting French architecture for American journals such as *Progressive Architecture*. She recently has been working with MIT's humanities department to encourage them to help set up an undergraduate study program in Paris (good grief! MIT students being less provincial and self-satisfied!)

Roy Harris reports that, as with many New Englanders, he has recently gone to California and joined Autodesk after a long career (30 years) in the Boston area. His older daughter, Phoebe, has just graduated from Smith (and is apparently living in San Francisco near my Smith graduate daughter—wonder what it is that attracts them?). His younger daughter, Emily, is a sophomore at Barnard and continues to pursue premed studies ("She's wanted to be a doctor since age 4 and a surgeon since age 6").

On a somewhat sadder note, I report the death of **Richard J. Long** of Endicott, N.Y. Richard had most recently worked with Singer Linc in New York. He left a wife and three sons.

In the follow-up portion of the column, I recently enjoyed reading a long article in the Sunday *Boston Globe* on "a specialist in the arcane field of the mathematics of queues." The author was, in fact, featuring **Richard Larson** again for his waiting line trouble-shooting. . . . **Regina Herzlinger** continues to add to her business responsibilities with a recent appointment to the board of directors of Manor Care, Inc.—**George McKinney**, secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167, (617) 890-5771

66

Please send news for this column to: **Eleanore Klepser**, secretary, 84 Northledge Dr., Snyder, NY 14226-4056

67

Please send news for this column to: Sharlotte and **Jim Swanson**, co-secretaries, 878 Hoffman Terr., Los Altos, CA 94024

68 25th Reunion

We are getting down to the home stretch for our gala 25th Reunion on June 3–6. You should have received at least one reunion mailing by the time you read this; if you haven't, the computer is confused, so please contact us ASAP. As we reported last month, a group of us met in Cambridge in September to get the ball rolling for our Reunion Gift planning, and other reunion activities. Joining in the effort were: **Steve Finn** (Reunion Gift Chair), **Bob Anthonyson, Lyn (Wiesenberger) Bruneau, Nick Covatta, Karla (Hurst)** and **Rick Karash, Rick Lufkin, Richard Raysman, Steve Swibel**, Joanne (Haponik, '70) and **Art Cole, Claude Gerstle, Scott Marks**, and ourselves. Returns from the first mailing are starting to arrive and the following individuals, in addition to the above planners, have indicated they plan to come: **Scott Mermel, John Nardello, Buck Haberkorn, Jeff Reece, Paul Gluck, Barton Stuck, Tim Johnson, Richard Boyatzis, Richard Raysman, Alician Quinlan, Jerry Grochow, Jim Carlo, David Ellis, Stanley Cygelman, William Hutchison, Frank Sheeman, Shan Cretin, Harold Levin, Dan Green** and **Andrew Schiff**. Our thanks to this group for showing an early vote of confidence in the plans of our committee. Keep watching your mailbox for more news.

After being somewhat short of news for a while, we now have a backlog as the reunion responses start coming in. We will try to work through all this news in the next few issues, so please be patient. . . . After 10 years in the Army, mostly as a captain in the Corps of Engineers, Frank Sheeman joined a startup computer company in early 1977. He is still with Tan-



Since the Geltmans couldn't make it to the Class of '67's 25th Reunion last June, their friends held a mini-reunion for them when they came to Boston in September. From left: Gary and Barbara Englander, Ed and Nancy Geltman, Joel and Elaine Shwimer, Chuck Cooper (his wife, Monica, was taking the photo), Janice and John Rudy, and Elaine and Jeff Wiesen. The men are all members of the Class of '67.

dem Computers doing special projects and flying to Shanghai a lot. . . . **William Hutchison** reports that he "finally escaped" from Unisys to Soft-Switch, Inc. . . . Susan and **David Ellis** and their two daughters (ages 13 and 10) spent a month in Spain and France last summer. The girls performed with a dance group at the American Pavillion at the World's Fair in Seville. David is a lawyer in Largo, Fla., practicing computer, copyright, and trademark law and teaching a course at a local law school.

Last year we announced the Youngest Child at the Reunion contest and got several entries. The following news has inspired another contest—the First Classmate To Send a Child to MIT. It looks like the first entry will be from **Claude Gerstle**, whose son, Ari, is now a freshman at the Tute. Anyone with earlier entries? More than one child at MIT? Claude's daughter, Jessica, is a junior at Columbia and works as an intern for the *Today* show. Obviously his wife, Ellen, was inspired by all this academic effort and quit her job as his office manager to study for a PhD. . . . Since last April, Tim Johnson has been acting manager of the Control Systems Lab at General Electric's R&D Center in Schenectady, N.Y. Nancy and Tim's son, Grant, graduates from SUNY at Purchase in June, majoring in fine arts. Their daughter, Kaija, is a freshman at Case Western Reserve with interests in biology and varsity soccer. Nancy teaches GED students, weaves, and gardens.

Joan and **Paul Gluck** lost their sailboat to Hurricane Andrew, but were out of town when it struck Miami and had no other damage. Paul is busy in his OB/GYN practice and has major roles in several medical societies. Joan is a practicing allergist and also is a leader in several societies. They have collaborated on medical research and recently completed a chapter on asthma and pregnancy for a forthcoming textbook. When not attending medical meetings, they enjoy traveling and sailing with their children, George (12) and Miriam (9). . . . After working for 17 years for the Port Authority of New York and New Jersey, **Steve Passage** left in 1986 to join an American subsidiary of a French firm, Monterray International Corp. His field is environmental and energy-related businesses serving municipalities and counties. Ellen and Steve have been married for five years and live in the Big Apple.

Alan Guth has been teaching in the MIT Physics Department since 1980, working in particle theory and cosmology. During the fall semester he was on sabbatical, working on a popular book on cosmology. . . . Lydia and **Dan Green** live in Williamsville, N.Y., with their children, Amy 6; Sarah, 4; and Danny, 2. Dan is a pediatric oncologist and has written several medical texts. He is professor of pediatrics at the School of Medical and Biomedical Sciences, SUNY Buffalo.

That's all we have room for this month. We're looking forward to seeing you all again in June in Beantown.—**Gail** and **Mike Marcus**, secretaries, 8026 Cypress Grove Lane, Cabin John, MD 20818

69

David C. Hill writes that he and his family moved to Chesterfield, Va., in June and are "enjoying southern life."

I continue to receive news clips about our famous class actor, **James Woods**, so I will continue to write about him. For those few of you who don't like the movies (all 27 of them since 1973), tough! In an interview in the *Medicine Hat News* of Medicine Hat, Ala., we read these choice nuggets from Woods: "The house I grew up in cost less than the car I'm driving"; "I may not be great looking, but I'm not getting any uglier." He follows these with his shot at the world, "I've been burned by really bad people with disgusting backgrounds and no family values. . .And I want to make it clear that I am not referring to any specific individual, but I've been burned by really despicable trash who presented themselves in a different light."

Woods continues: "I have checklist and I'm not even polite about it. Now when I meet somebody I ask: 'Are your parents together? Do they have family values? Do they go to church? Are they alcoholics? Drug addicts? And where's the blood test report from your doctor?' Damn right I ask!" The latter sounds just like his *Saturday Night Live* routine of recent times.

Michael Warren sent me a lengthy letter from Gainesville, Fla., describing his life since getting a PhD in electrical engineering at MIT in 1974. After MIT he was a faculty member at the University of Florida for some time. In 1980, "Mickey" (or so he signed his letter) left UF to co-found an engineering consulting firm, System Dynamics, Inc., which was heavily involved in SDI work. Later he focussed on real estate development and construction under the name, AMJ, Inc.—an acronym for his three sons Andrew, Matthew, and Jeremy. Matthew is now a senior at MIT majoring in biology. Jeremy just entered MIT in 1992. Andrew is a high-school sophomore. But lo, now we hear of daughter Stacey, who will be three years old when you read these notes. With two sons now at MIT, Mickey and wife, Phyllis, plan to spend more time visiting Boston and "hope to see many of our MIT friends during our travels."

As for yours truly, in October I returned from the Third International Conference on Cold Fusion in Nagoya, Japan, and was quoted in a welcome article in the *New York Times* Science (November 17, 1992). Check it out. My prediction based on the Nagoya experience: Prototype cold fusion powered home heaters in 1993, electric generators in 1993 or 1994.—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

70

Ron Stoltz writes that he is working on concurrent engineering, rapid prototyping and the use of high speed data networks for manufacturing information at Sandia National Laboratories' center for advanced manufacturing technologies in Livermore, Calif. In particular, Ron is responsible for programs at the Integrated Manufacturing Technologies Laboratory focusing on the welding and machining of metals and advanced fiber-reinforced composites. Ron says, "I haven't had this much fun in years!"—**Greg** and **Karen Arenson**, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

71

Please send news for this column to: **R. Hal Moorman**, secretary, Box 1808, Brenham, TX 77834

72

Eugene Kroch left the Penn Department of Economics to spend a year at the New York Fed. "It was a great year professionally, but I am glad to be back in Swarthmore with my family. Spending work weeks in NYC and coming home just for weekends was a great strain for all of us. Well, back to university life—it's not so bad." . . . **Rafael Bras** has been appointed head of the Department of Civil Engineering at the Institute. He is a hydrologist specializing in the interpretation of natural phenomena as random functions and has been on the faculty since 1976. . . . **Jerzy Novosielski** has cofounded an imaging software company, Performance Support Software. . . . **Gary Stahl** writes that he "joined the Department of Pediatrics at Hahnemann University in Philadelphia in January 1991 as associate professor and associate director of hematology. Debbie has a new career as a children's performer in addition to being a full-time music teacher. Our sons, Adam and Eric, are now 10 and 4."

I got a nice long letter from **Joe Kashi**: "I still live in Soldotna, Alaska, a small summer resort town about five air miles southwest of Anchorage. I have been practicing law for about 10 years. My office is next to my wife, a PhD psychologist with her own

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practice. It was quite a culture shock to move her in 1977 from Bethesda, but I have never regretted it - except perhaps on one of those cold winter nights three days after we get back from Hawaii. There is no grander place to be during the summer but unfortunately spring, summer, and autumn together last about 6 1/2 months. that means 5 1/2 months of winter interspersed with about two weeks in Hawaii ($400 away).

"I have been quite busy practicing with three other attorneys in our small office and seem to have achieved a certain degree of national notoriety as a speaker and author on law office automation. From 1984–1990, I was president of the county bar association. More recently, I have become active with award-winning community service projects sponsored by our local Rotary Club, both here and in Magadan, Russian Far East. Over the years we have dined and boarded many visitors from Russia. At the moment we are trying to totally refurbish and re-equip the antiquated children's ward at the Magadan Hospital.

"In 1991, I became one of the co-chairs of the ABA's local area network group and vice-chair of the litigation computer applications group. I am also now the contributing editor and product review editor for *Law Office Computing*, a major national legal automation magazine. Recently, I co-authored and helped edit the ABA's new two-volume series on law office automation. I generally travel to other parts of the United States 8 to 10 times a year. These trips minimize any feeling of being isolated north of the 60th parallel.

"About 10 years ago, I bought a twin-engine Cessna and learned to fly. Now, with Anchorage only 35 minutes away and an old car at the airport, we are no longer shut out of culture or good restaurants or a Nordstrom department store. Because of the press of other out-of-state business I could not attend the reunion, but look forward to seeing my classmates in 1997."—**Dick Fletcher**, co-secretary, 135 West St., Braintree, MA 02184

73 20th Reunion

David Boucher has retired as CEO of Interleaf, the company that he founded in Cambridge. He will continue on as chairman of the board. It had been my intent not to announce anything that smacked of "retirement" in these pages until we all had reached a civilized retirement age of, say, 42, but David's accomplishments merit his being the first to be so described. Congratulations to him.

As much as I try, I cannot find another piece of news in the envelope. Your classmates, my friends, are waiting to find out how your tomatoes are doing, or that you have been elected governor of South Dakota, or the birth or college graduation of a child. Or just "Hi, there."

All is well here on the home front. Looking forward to the 20th (gulp!) reunion and meeting old friends. Write!—**Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

74

For those of you who did not receive it as a holiday gift, you can still obtain your own copy of *Riemannian Geometry: A Beginner's Guide* by **Frank Morgan**. Frank is chair of the math department at Williams College. Reading the introduction reminds me of why Course 18 wasn't a wise choice for a major for some of us! . . . **Dave Godfrey** was recently promoted to senior manager, Audit Department, at Deloitte & Touche. Working with the MIT Enterprise Forum of New York on a December presentation on Strategic Alliances has been interesting and absorbing. . . . **Jia Shu** is as confused as is MIT. He started with our class, graduated with the Class of 1976, and receives mail connected with both classes. Jia is a senior project manager with Transaction Technology, Inc., a hardware/software subsidiary of Citibank. In his second year on the Educational Council, Jia at last had his first interview. Lovely wife and three active children fill the rest of his time. . . . For those of you lacking the time/resources/ability/desire to write, expect a phone call. In sharing with **Lionel Goulet** the task of writing this column, I take seriously the responsibility to bring all in our class to the bright light of public exposure. My standing invitation: if ever passing through Mt. Pleasant, Iowa, (get out the atlas) be sure to visit!—**Dave Withee**, secretary, 1202 Linden Dr., Mt. Pleasant, IA 52641

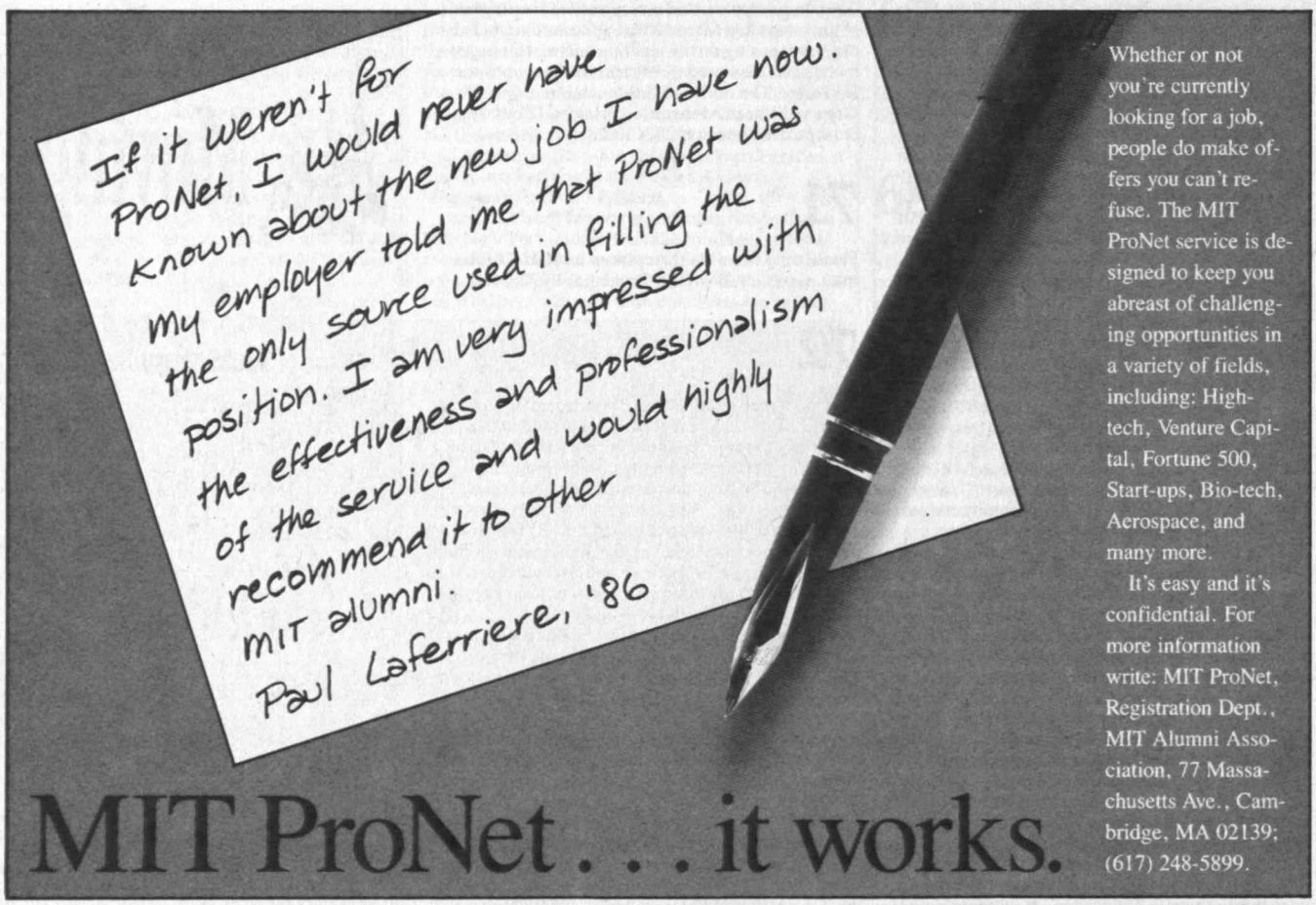
75

Please send news for this column to: **Jennifer Gordon**, secretary, 18 Montgomery Pl., Brooklyn, NY 11215

76

Send news. We need it. You have a variety of media available: letters, faxes, modem, and phone calls.

Mark Suchon writes: "It's been over 15 years since I last wrote in. I'm finally writing due to our class secretary's pleas for news. So, come on everybody, let's help him out! There's lots of you out there we haven't heard from. . . . For the last few years, I've been 'domestic engineer' and currently 'Mr. Mom' to a 2 1/2 year old daughter and a newborn son. Despite my college degree, I decided to marry a PhD. I earn some pocket money doing some consulting but mostly by teaching part-time at the community college level. I was exposed to this through my wife, Donnetta, who is a dean. If you're interested in teaching part-time, or just want to try it, community colleges are the way to



go. There's no experience or training required (generally just a master's degree or above) and no long-term commitment. . . . You may even be qualified to teach areas other than your major: my Chicago MBA has allowed me to teach math and economics. I've had a lot of fun, plus the satisfaction of participating in education, a controversial subject these days. Feel free to contact me for details: 4313 Egret Dr., Seabrook, TX 77586, (713) 474-5313."

Tom Stohlman launched an effort to run for State Representative for the 21st Middlesex District in Massachusetts. This encompasses Reading, North Reading, and Precinct 6 in Wilmington, Mass. Unfortunately, your secretary was not able to learn if he was successful in his campaign for public office prior to the due date for submission of this issue of the Notes. Tom is an architect, and has already had government experience at the local level in Reading. We also have a letter from **Mike Paluszek**: "After getting a degree in VI-A in 1976, I stayed at MIT for three more years to obtain an engineer's degree in aeronautics and astronautics. Following graduation, I spent a year working as a research associate under Professor Manuel Martinez-Sanchez. I then joined the Charles Stark Draper Laboratory where I worked on the Space Shuttle Orbiter, flexible space structure control, and Space Station Freedom.

"In 1986, I took a position at GE Astro-Space division in New Jersey as an attitude control system designer. I designed the platform pointing control system for the NASA Global Geospace Polar mission, led the design team that developed the Global Positioning System Block IIR attitude control system, developed a series of interactive satellite simulations, flew nearly every GE commercial satellite, and made major contributions to the organization of Astro-Space Division, including the creation of the Inmarsat 3 Flight System Design Team, which became the model for engineering team organization at Astro-Space.

"In 1987, I married Marilyn Ham, Simmons College, '76. Marilyn worked at MIT for many years and is now the department manager of the Music Department at Princeton University. Marilyn and I have been very active in the MIT Club of Princeton. Marily was VP of membership in 1989 and we were co-presidents in 1990 and 1991.

"In November 1992, I left GE Astro-Space to form Princeton Satellite Systems, Inc., where I am president and CEO. The company was created to fill critical industry needs in the area of satellite control system design and flight software implementation. Princeton Satellite Systems will provide complete attitude control systems and flight software packages for satellite manufacturers. The company's product line will be spacecraft simulations and specialized mathematical and CAD software packages. As the company grows we will be focusing our research and development on critical spacecraft technologies that are needed for the next generation of satellites. Starting up the company has been a lot of fun, and I expect 1993 to be an exciting year."

As for your secretary, he is still getting thrills and profits out of the bond market and foreign exchange trading. Nothing like a good convulsion or two, and a presidential election to stir things up. Volatility is one of my better friends. When not trading, I continue to pursue business in computers and telecommunications. The economic doldrums we have been in have actually been good for this business effort—companies want to automate further in order to eliminate more people. The process continues to feed on itself. So here I am, attempting to profit from economic distress by trading, and by furthering the permanent replacement of white collar workers with computers. Having traded futures for so many years already has made me very sensitive to a)living at the edge, and b) the ever present need to automate so as to cut paperwork and the people needed to handle it.

Please write, fax, or call. We need your news.—**Arthur J. Carp**, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523, Tele: (516) 295-3632, Fax: (516) 295-3230

77

Geoff Landis sent me an e-mail note "mentioning" that he was awarded the Hugo Award for the best short story of 1991 for his work "A Walk in the Sun." Congratulations! The January 1992 issue of *Asimov's SF Magazine* carried his newest story, "The Brilliance of the Winter Stars." . . . **David De Bruin** wants us to know that he became a patent attorney in 1991 to expand his litigation practice into patent litigation. In July 1991, he and his wife took their children to Baja, Calif., for the solar eclipse. . . . **Steven Grossman** was sorry that he missed us at the reunion in June, and plans to join us in 1997. He is still working at Advanced Micro Devices as director of operations for the Non-Volatile Memory Division. He is living in Los Altos, Calif., and invites classmates who visit the area to look him up.

Harvey W. Kaufman, M.D., returned to Cambridge and is medical director of MetPath New England, Inc. . . . **Paul Ackman** was at the reunion with his girlfriend from Serbia, Jasmina Bogicevic. She is pleased to have gotten a visa and she is staying in Richmond with Paul. . . . Also at the reunion were **Debbie Darago** and her husband Cal Winey, '79, and daughter Tatiana, 7. Their other daughter, Larissa, 10, was at a dance program. Both girls continue to study violin and dance. . . . Another Debbie in attendance was **Debbie Stutman-Brickey**, who was spending a lot of time at home in Ohio with her two youngsters, who are 3 and 4 and quickly learning the alphabet and counting in six languages. She is involved with Science by Mail out of the Boston Museum of Science. Debbie also attends local AIChe and American Chemical Society meetings.

That about wraps it up for all of the news I've been sitting on for the last few months. I have a long letter from **Dave Dobos** somewhere, which I hope to find before the deadline for next issue. Please write your letters on brightly colored paper so that I can find them more easily in the mess on my desk!—**Ninamarie Maragioglio**, secretary, 8459 Yellow Leaf Ct., Springfield, VA 22153-2522; e-mail; hertz!@xip.nrl.navy.mil

78 15th Reunion

News comes from **Frank Murphy** who called your class secretary looking for a way to manufacture a newly-invented tool on which he and an associate are working. (Anybody out there got any ideas?) Frank is now deputy chief of the Cambridge, (Mass.) Fire Department. He is in charge of training, among other things. Frank says that he has made the department's training more hands-on (in the MIT tradition?). Frank and wife Sharon are the proud parents of daughter Leah who was born in February 1992. Their twin boys are now 3 years old. Frank and family are living in Waltham, Mass.

Paul Malchodi called while tending to his duties as a member of the Class of 1978 Reunion Committee. Paul and wife Rhetta both work for General Electric and are living in Lynn, Mass.

The Reunion Committee, chaired by **Frances Scovil** (a woman who knows how to throw a party!), is busily planning events and activities for our 15th reunion to be held in conjunction with Technology Day 1993. Plan to be there!

Kirk Reistroffer is chairing the Reunion Gift Committee. Members of the committee are **Peter Cheimets, Chester Hayes, John Jarve, Dave Lintz, Cordelia Price, Jim Roskind, Bill Fejes, Sue Kayton, Theresa Nolet**, and our friendly class president, **Milton Roye**. The committee is busily canvassing the class for donors to the Alumni/ae Fund, particularly for the Class of 1978 Student Aid Fund. Participation is important—please be generous!

Milton Roye has been promoted to director of program management of General Motors' Fisher Guide Division. He has sales responsibility for about $550 million worth of parts for Cadillac and Saturn cars. Milton says Fisher Guide produces "everything you can see on the cars except sheet metal and instrument panels." Milton also says the anticipated restructuring at GM has him incredibly busy. At this writing, your class secretary, wife Diane Curtis, and kids are very much looking forward to a visit with Milton and family over the Thanksgiving weekend.—**Jim Bidigare**, secretary, 9095 North St., NW, Newark, OH 43055-9538, (614) 345-8582

79

Fred Berretta has joined the La Jolla, Calif, law firm of Scalone Stipanov Yaffa & Mebane as an associate. He will practice in the firm's Litigation and Corporate Law Group. Previously, Fred was in-house counsel for National Health Laboratories in La Jolla. He received his law degree from Harvard Law School. . . . **Michael Wax** has become the deputy director of the Institute of Clean Air Companies (ICAC) in Washington, D.C. He will be responsible for technical projects and liaison work with government air quality officials. Michael received a PhD in inorganic chemistry from the University of California at Berkeley in 1983. He is the holder and co-holder of four patents.



Fred Berretta

Marvin Chartoff and Janice (Cohen) Chartoff, '81, are the proud parents of Sonya Lynn, born June 12, 1992. The Chartoffs live in Fairfax, Va. . . . The autumn 1992 newsletter of the Association of MIT Alumnae (AMITA) shows two classmates on the executive board: **Lisa Bendixen** is the membership chair, and **Meredith Warshaw** represents the AMITA/UROP Oral History Project. Lisa and Meredith, please fill us in!

I'm sorry to say that a recent issue of *Technology Review* listed **James Paddock** among the deceased. I have no further information, other than a date of April 6, 1992. If any of you have information to share with classmates, please send it to me.

Tomorrow night is opening night for my latest musical, *Dames at Sea*. After that, I'm off for a two-week trip to Paris. I hope to find a mailbox full of classmate news when I return.—**Sharon Lowenheim**, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

80

Just one short note this month from **Barbara Hill Thornton.** Barbara writes that she is "still employed, which for an architect in this economy, is pretty good." Her recent projects at D. Presbrey Architects in Providence, R.I., include university renovation projects for three different schools.

I hope to hear from more of you soon. If you have made a pledge to the Alumni/ae Fund send your news on the "activities card." You can also write, call, or e-mail your news to me at: **Kim Zaugg**, secretary, 2384 Leslie Circle, Ann Arbor, MI 48105, (313) 665-2365, vayda@erim.org.

81

As I write this, the elections are just past. I hope at least some of you are satisfied with the results. As for yours truly—no comment.

On top of Mt. Fuji: We have a remarkable report from **Joann Stock** this month. Joann is presently chasing earthquakes as an associate professor in the Geological and Planetary Sciences Division at Caltech. Last August, Joann went on her first trip to Japan, to the International Geological Congress in

Kyoto, and stayed in Japan for a month. The day after she arrived in Japan, she went off to climb Mt. Fuji (along with her husband Brian Wernicke, PhD '82) and her sister Margaret. About halfway up the trail, she ran into someone who looked familiar. It turned out to be **Robert Vander Heide**! It seems that Robert was hiking with a group of the "International Adventurers Club." He now lives and works near Osaka. If that isn't wild enough, consider that this encounter occurred during the night, since everyone, including Joanne, Rob, and about 3,000 Japanese, was trying to reach the summit in time to see the sunrise. It was a weekend night with a full moon, and the weather was good, which allowed the two mountaineers to recognize each other.—**Mike Gerardi**, secretary, 21206 Glenmoor Dr., West Palm Beach, FL 33409, (407) 655-5050 (w), (407) 683-4003 (h)

82

There is not much news this month. I did receive my first contribution to the class notes via Compuserv from **Dean Koutsoubis** this month. He writes that he and his wife, Barbara, are still living on Long Island. Things are going well with his consulting practice, providing engineering and computer services for the construction industry. The big news this year is the birth of his second son, Christopher George, on June 10, 1992. His oldest son, Michael, celebrated his second birthday in April. Thanks, Dean, for the great news!

The Air Force has promoted **Jeff Lukas** to the rank of major. He is a pediatrician at Altus Air Force Base, Altus, Okla. . . . As for me, I'm doing fine. I have been taking a vision improvement course based on the Bates method, which really does work! My goal is to pass my drivers test without corrective lenses.—**Helen (Fray) Fanucci**, secretary, 502 Valley Forge Way, Campbell, CA 95008, CIS 74005,744 (or Internet 74005.744@CompuServe.COM)

83 10th Reunion

The following is a quick run-down of our class reunion events scheduled for June 4-6, 1993. Friday night will feature a get-together/cocktail party and dinner at the newly-renovated Student Center. The new Student Center is really something special. Food and drink stations will be strategically placed to please both those who want to mingle and those who want to feast. We will have the opportunity to renew old acquaintances and will be joined by professors and staff who were prominent during our era. If you have any suggestions of popular (some of you may prefer to use the term loosely) professors or staff members that you think should be invited, please give me a call at (617) 574-6773. Along these same lines, a special mention will appear in these pages for anyone who donates a frequent flyer ticket that will enable us to fly in 18.02 Professor Frank Morgan, who is currently teaching at Rice University in Houston.

Saturday morning will feature an Entrepreneur's Workshop. This will be sponsored in conjunction with the 25th Reunion Class. Saturday afternoon will feature the "Techsas" barbecue, and in the evening there will be a joint event with the 5th and 15th reunion classes. Details will be announced, but the word is that MIT is contributing Big Bucks. Sunday's brunch will include class elections, so get your nominations in soon, especially for the highly-coveted position of class secretary.

The class reunion chair is Sarah Bingman. The committee includes **Sue Feindt, Jinsoon Moon, Mickey Goldberger, Paul Nahass, Mary Wasilewski Roberts, Joyce Himawan, Hyun-A Park** and yours truly (at least these are the people who showed up at a recent planning meeting—conveniently scheduled just after election day, affording Hyun-A the opportunity to gloat in the Democrats' victory). Sarah is working for Nepera Chemical Co. in Harem, N.Y. Sue works at Analog Devices. Mary is a design engineer at Teradyne. Paul works at Hyperion Catalysis in Lexington, Mass. Paul also reports that he and his wife, Jennifer, are off to New Zealand over the Christmas/New Year holiday. Paul says that **David Lebow** married his grad-school sweetheart and is now a father living in Washington, D.C.

And now for the news that I didn't have to squeeze out of people. **Mike Santullo** writes that he has ended his world-wide tour and is back in the Palo Alto area. Mike is doing consulting work in the multi-media software area. He also reports that **Kian Nobari** is developing real estate in Marin County. In addition, Mike reports that **Jeff Muss**, marriage under his belt, has taken it upon himself to construct a walk-in wine cooler. His friends are surprised—Jeff's previous construction experience has been limited to building funnelators at Delta Tau Delta.

Our annual installment from **Layton Montgomery** comes a little early this year, as Layton is heading out of circulation for a while. He is going to Luiv, Ukraine, for a year, where he will teach at a school, help a new international education office within the ministry get off the ground, perform database work for a private computer company, and sing with the Ukrainian Choir. Layton spent the past summer tutoring English and linear algebra, working on his unions' grievance board, studying Ukrainian, living at a Sikh ashram, and bicycling 80 to 100 miles per week.

Eric Johnson writes that he will be getting married in October 1992, to Debbie Busk. Debbie and Eric met in 1991 at a Boston College football game, and they plan to live in Portland, Maine. . . . **Elizabeth Bradley** writes that she will be an assistant professor in the Computer Science, Electrical Engineering, and Applied Mathematics Department at the University of Colorado at Boulder. Elizabeth starts in January—just in time for ski season.

Remember, please contact me with your suggestions for professors and staff you would like to see at our cocktail party on Friday night.—**Jonathan Goldstein**, secretary, c/o TA Associates, 45 Milk St., Boston, MA 02109

84

Bethany Foch was our Class of '84 Scholarship recipient for 1991–92. She is a native of Oakland, Calif., and is majoring in aero & astro. Bethany is a sister of Alpha Phi and plays on the first string women's varsity volleyball team. She has been working summers for Boeing's helicopter division in Philadelphia.

Please write to your lonely secretary:—**Howard Reubenstein**, secretary, 28 Mitchell Grant Way, Bedford, MA 01730, (617) 275-0213 (home), e-mail: hbr@mitre.org

85

Please send news for this column to: **Bill Messner**, secretary, 8 W. Winkley St., Amesbury, MA 01913

86

Apologies to the class for the shortness of these notes. I'm in the middle of moving from L.A. to Washington, D.C., and right now I'm spending seven weeks at Squadron Officer School in Montgomery, Ala. Most of my stuff is in storage, including my alumni listing! So, since I received NO news this month, this will be brief.

Betsy Salkind is still a comedian and performance artist. She recently completed a second run of a one-woman show at the Institute of Contemporary Art and a pilot for PBS. . . . **Thomas Kurfess** is an assistant professor at Carnegie Mellon University in the Departments of Mechanical Engineering and Engineering and Public Policy. He was awarded a 1992 National Science Foundation Young Investigator Award. This award finances research of faculty members near the beginning of their careers.

As I mentioned, the Air Force is moving me to northern Virginia where Erik and I just bought our first house. We closed on November 11th, our three-year wedding anniversary. Erik got out of the Air Force and I gained a dependent. Please note the new address and WRITE!—**Mary C. Engebreth**, secretary, 21305 Arrowhead Ct., Ashburn, VA 22011

87

Phil Sanchez was married on August 8th in Providence, R.I. His wife, Gloria, made her own wedding dress, which was reported to be "simply amazing!" MIT alumni in attendance included Diane DiMassa, '88, Javier Tam, '88, Debbie Lee, '88, Steve Smith, **Carlos Flores**, Darlene Flores (De Wilde), '88, and George Deltas, '88. Carlos is doing his residency in radiology in Tucson, Ariz. Phil and Gloria are now living in Binghamton, N.Y., where Phil is working as an actuary.

No other "fresh" news came my way this month, so the rest of the column comes from our Class Register. . . . **George Borhegyi** lives in Medford, Mass., and works for the Cambridge Institute for Information Systems. . . . **Amanda Bosh** is a graduate student at MIT and serves as a member of the MIT Educational Council. . . . **Andrew Braunstein** lives in Chestnut Hill, Mass., and works for Hewlett-Packard in Waltham. . . . **Robert Brodersen** is a senior development manager for Oracle Corp. in Redwood City, Calif. . . . **Valerie Brown** is at the University of Pennsylvania and serves as the director of the MIT Club of the Delaware Valley.

Hei Chan is an analyst for Morgan Stanley in New York City. . . . **Linda Chao** lives in Chelmsford, Mass., and works for Digital Equipment. . . . **Alex Charney-Cohen** is a manufacturing engineer at the Square D Co. in Lexington, Ky. . . . **Cheng Hwee Chee** is a test engineer at Apple Computer in Freemont, Calif. . . . **David Chen** is a consultant for Andersen Consulting in Washington, D.C. . . . **Lesley Chen** is a graduate student at Carnegie-Mellon University in Pittsburgh, Pa. . . . **Norman Chen** works for the MAC Group in Cambridge.

Patricia Manning is an engineer at Livermore National Labs in California. . . . **Jeffrey Marchuk** is a senior mechanical engineer at Motorola in Plantation, Fla. . . . **Daniel Margolis** works for AT&T Bell Labs and lives in Hazlet, N.J. . . . **Mark Mastandrea** is in the MIT Leaders for Manufacturing Program. . . . **Jeffrey Math** works for the Northrup Corp. in California as a senior engineer. . . . **Susan McDermott** is a power technology engineer for du Pont and lives in North Augusta, S.C.

Chung-A Oh is a consultant for Apple Computer and lives in Cupertino, Calif. . . . **Elizabeth O'Neill** is a graduate student at the University of California at Berkeley. . . . **Maria Palmese** is an associate patent attorney at Kenyon and Kenyon in New York City. . . . **Eugene Pan** lives in Waltham, Mass., and is an IC design engineer for the Kendall Research Corp. . . . **Joseph Paplia** is a manufacturing manager for the Eminence Speaker Corp. and lives in Shelbyville, Ky. . . . **Eric Park** is a R&D Engineer for Hewlett-Packard in Avondale, Pa. . . . **Elizabeth Parker** lives in Evanston, Ill., and teaches science at New Trier High School in Winnetka. . . . **Felix Partow** lives in Brooklyn and is with Morgan Guaranty Trust Co. . . . **Erica Pascal** is a post-doc at the University of Illinois at Urbana/Champaign.

I hope I won't have to resort to the Register on a regular basis. So write, call, or email your news/gossip/funny stories about you and your classmates to me!—**Jack Leifer**, secretary, 2703 Swisher St. #202, Austin, TX 78705, (512) 472-7507, e-mail: leifer@ccwf.cc.utexas.edu

88 5th Reunion

The Class of '88 reunion is only a few months away! We now have over 25 people involved in either the reunion or reunion gift committees! Our reunion committee is now being co-chaired by **Joycelyn Koehler** and **Sheila Neville**, who have been busy planning exciting events and have recruited an enthusiastic committee to help out. Committee members include **Jim Casamento, Sharon Els, Erik Heels, Suzanne Maggioni, Abdon Ruiz, Kimber Lynn Zinger, Carla Kapikian, Lon Sunshine, Reggie Tucker** and **Cathy Singer. Jim Casamento**, our nominations chairperson, is organizing nominations for class officers and preparing for elections that will take place at the reunion (details were included in the fall mailing).

By now you should have received at least two letters/cards about reunion and reunion gift activities. If MIT does not have your current address and preferred class affiliation, you can notify the Records Office. Also, **Erick Heels** has offered to send reunion news through e-mail. If you are interested, the Records Office can add your e-mail address to the data base. We wouldn't want you to miss out on any exciting news!

Our reunion gift committee has done a great job in working towards meeting our Class of '88 gift goals. Much thanks to those of you who have donated! If you haven't, there's still time! You may want to designate your gift to the Class of '88 Scholarship fund—the fund is already partially supporting students! Also, donations over $100 will receive a handsome barrel bag, and all donors will receive a Class of '88 decal. So don't miss your chance! And stay tuned for future reunion updates!—**Grace Ma**, secretary, 19 Candlewood Rd., Lynnfield, MA 01940

89

Well, this is the month my null column came out, and I guess I had gotten my hopes up in expecting people to write because there was no news for a month. I didn't receive any new mail! Please, please write and send in pictures for our calendar!

Here are this month's list of people to write in: **Laura Carter, Joel Kehle, Sharon Moran,** and **Paul Thomas**. What are y'all up to? If anyone knows about any of these people or anyone else, please write!

Julia Putnam writes, "I am still working for Ethicon Endo-Surgery, a Johnson & Johnson company that makes surgical devices. I was recently promoted from advanced technology (the R&D side of things) to procedure development manager in charge of pediatrics and urology. My job is to define the strategy for the company in the area of pediatric surgery and urological surgery, working closely with surgeons to develop new techniques, procedures, and instruments." Julia also recently became engaged to Thomas Taylor, LFM '91. Julia and Tom are planning an April '93 wedding. Tom is working for GM in Dayton, Ohio. . . . **Joe Lichy** and **Elizabeth Greyber** recently got engaged to be married, and are planning an April wedding. . . . **Teri Centner** has been reassigned to McClellan AFB as an advanced composites engineer. Reporting in January, Teri is thinking about joining the MIT Club of Northern California once she gets there. . . . **Cristina Vilella** will be heading to Wright-Patterson AFB in late April to get a master's degree. Christina will be attending the AFIT for a year and a half. . . . **Jason Nieh** presented a paper at a conference in Boston in November. Jason passed his orals at Stanford last year, and is now doing work in multimedia.

Eric Tang is working for Electronics for Imaging. Eric lives in Foster City, Calif., with **Curtis Chen** and Ken Lu, '90. . . . **Mike Berube** is an "energy and alternative fuels planning specialist" with the Chrysler Corp. Mike is living in Auburn Hills, Mich. . . . **Ed Kim** writes from New York City, that his "year in San Francisco was interesting, therapeutic, and thoroughly fun—it felt almost like a long working vacation. But it's time to get back to work. New York is still, in my mind, the most vibrant, frenetic, 24-hours-a-day city anywhere, and above all else, it's home—where my family is, where my friends are, and definitely where my heart is." Ed has started a new job in the Asian Equity Sales group of Lehman Brothers, marketing stocks of Asian companies to U.S. institutions. Well, that's all the news I have for now. If people don't send in news, I will have to start making it up!—**Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142, (617) 225-6680, e-mail: tripleh@athena.mit.edu or henry_houh@mit.edu

90

John Mruz writes that he's been working at GE in Utica, N.Y. He has just completed his third rotational assignment in radar/electronic warfare systems analysis. At the same time, John has also completed a master's in electrical engineering at RPI and will be receiving his degree in April. Back in August, John got engaged to Christine Oswald, Princeton '92. Christine is a student at the Harvard Law School. They plan to be married in August '94. Congratulations!

Anne Law is still living in Hamburg, Germany. In August, she got an unexpected visit from Marcel Eberle, '88, who was in Switzerland visiting his rel-

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atives. While they were having a great time reminiscing about old times, they started wondering what **Lisa Oliveira** and **Eloisa Tejero** were up to. Anne was back in the States over the summer for a two-and-a-half-week stay, visiting family in St. Louis and friends in Boston. In Boston, Anne saw **Jee-Hoon Yap** and **Mike Valdez**, both excellent musicians who are still pursuing music! Back in Germany, Anne spends time as a MIT educational counselor. In September, she conducted her first application interview!

Jee-Lian Yap is working in Boston at the MBTA as a technical writer. She also does volunteer work with teenagers for the Boston Church of Christ. . . . Last April, **Doug Sabin** competed in the Olympic Sailing trials in California. Recently, Doug quit his job servicing nuclear power plants at ABB Impell in Waltham, Mass., to design bumpers for shopping carts at McCue Corp. in Salem, Mass.

Some news about fellow Bakerites. **Allison Hochstein** writes that after graduation, she spent two years working at Arthur D. Little in Cambridge as a management consultant. During that time, she shared an apartment with **Liz Ambrogi**, who works for Hewlett-Packard in Somerville. Allison is now in a graduate program in human factors engineering at Georgia Tech in Atlanta. Human Factors, otherwise known as engineering psychology, involves designing machines and computers with the end users in mind. Allison is studying for a master's and considering getting a PhD. . . . **Armando Fox** has finished a master's in electrical engineering from the University of Illinois and is now working for Intel in Portland, Ore. . . . **Jack Kotovsky** has finished a master's in mechanical engineering from MIT and is currently in Paris, France.

Katherine Williams writes that after graduation, she spent part of the summer on a bicycle tour with **Charles Wong** and **Jeff Morgenthaler**. Then she went off to graduate school at UC Santa Barbara. Her office was within 200 yards of the beach, which was a nice change from the Muddy Charles! Last spring, Katherine received a master's in materials (diamond films) but the big news is that on October 10, she got married to Clarkson alumnus Drew Derbyshire. They held a small ceremony in Lockport, N.Y., and honeymooned in San Francisco.

Mark Storm is currently an independent affiliate with the Baran Group in Framingham, Mass. He is actively involved in something called multilevel marketing and encourages classmates to contact him to learn more about this area of business. Mark can be reached at work: (508) 879-4026.

Thanks to everyone who wrote in! Hope to hear from more of you this year! Please send news: **Ning Peng**, secretary, 305 Memorial Dr., Cambridge, MA 02139, or ning@athena.mit.edu

91

"Greetings from Princeton!" writes **Cait Crawford** on a postcard picturing the university's Woodrow Wilson School. Cait is in her second year as a graduate student in mechanical engineering, but most of her research is in the applied math program. "I am using numerical simulation of complex geometry lines to develop turbulence models. I am pretty busy and I am also glad to say that after a year here my advisor has gotten used to my lack of shoes."

Congratulations to **Alexandra Montes**, who gave birth to Alexander Michael Gabriel on August 10, 1992. Alexandra and Alexander are both healthy and live in Brighton. Welcome to the world, Alexander!

"After a summer of hiking in the Grand Tetons, Yellowstone, Montana, Idaho, Oregon, Acadia, Georgia, Texas, and Indiana," writes **Susanne Perutz**, "I have finally settled down to work on my PhD at Cornell in materials science and engineering. Proud to say that the most socially active people in this department are MIT alums Steve Russell, Mike Russell, and **Laura Beecroft**."

Jeff Ludwig married Clare Tucker in Seattle on August 22, 1992. Clare is finishing an undergraduate degree in management at Boston University, and Jeff is pursuing a PhD in electrical engineering at MIT.

Dan McMahill recently noticed an ex-Boston police car, and then recognized that **Jamie Scanlan** was its driver. Dan learned that Jamie is still working at Bose in Framingham. Dan sends news about several other classmates: **Art Kalb** was married the week after finals last spring. **Karlin Anderson** married Sean McIntyre in November in Virginia. **Heidi Miracle** is working at the American Cancer Society in Atlanta. **Bennett Brown** is teaching in Chicago. **Roger Chen** and **Michelle Freed** share a condominium in San Francisco, where Michelle's cat just had kittens. Roger is working at Maxim and Michelle is at SRI.

After his first full school-year teaching high school mathematics, **Garrett Love** spent his summer training the next group for the Teach for America program. Garrett plans to continue teaching high school for another two years. He recently joined the small but growing group of homeowners in our class—Garrett and one of his roommates bought a house in Arkansas. Because they also rent the other rooms to a few boarders, Garrett may be '91's first landlord.

Lola Matysiak sends a postcard from Albuquerque with the colorful emblem from the hit musical "The Secret Garden" on one side and news about our classmates on the other side. Lola reports that in September, **Alyssa Parker**, **Shanna Kovalchick**, **Dan Henderson**, and Rob Lohr, '89, visited Lola in New Mexico. Alyssa and Shanna live in Vail, Colo., Dan is in New York City, and Rob lives in Somerville. Finally, says Lola, "I talked with **Alisa Mosler**, who is at Stanford and loves it!"

In September, **Pete Stewart** was engaged to Melissa Schulz, who is a Boston University alum now working in Manhattan. Pete spent the summer after his first year at BU Law working in a Providence law firm. . . . **Jane Williamson**, who is also at BU Law, was engaged to **Shawn Mastrian** during the summer. Shawn and Jane plan an August 1993 wedding. Jane is living with **Cynthia Madras** in Allston. They have gotten together with **Emil Dabora** and **Laura Adams**, who are working on PhDs at Harvard and MIT, respectively. Jane sends news about several other classmates: **Adam Braff** is at UVA Law. **Josh Ertischek** is in Alaska working for ARCO. **Cathy Morrison** works in Alexandria, Va., for a naval consulting firm. According to Jane, Cathy "survived the hot, muggy summer intact. Cathy sees **Melissa Chang**, who is with the Army in Maryland, among others, and visitors who pass through D.C., like **Frank Gutterman**."

Cheryl Klepser is still working hard on a ScD at MIT, and is looking forward to next year when she can perform research instead of just attend classes. Cheryl sends news about several classmates. **Lenore Abbott** is engaged to **Mike Friedhoff**, '90, and they plan a summer 1994 wedding. Lenore finished a master's from UMass/Amherst in December and is now at Polaroid in Cambridge. **Susie Jackson** and **Gary Quick** will marry in June 1993. Susie will then leave Baltimore and Johns Hopkins to live with Gary in Houston, and will continue to attend medical school there. The Navy recently transferred **Laura Moore** from the Philippines to Panama. During Laura's break, she stayed with Cheryl and, according to Cheryl, "did all the things she had missed doing in Boston." Laura was also able to visit with **Casey Santos** in Houston. Casey is working on space shuttles with NASA.

Both Jane and **Alex Min** send news about **Dave Haldeman**. Jane says that Dave is enjoying the California weather while he is training to be a navigator at Mather Air Force Base in Sacramento. Alex tells us that Dave is "learning how to sit in a back seat of a Navy airplane" and is "doing all sorts of secret things he won't tell me." Alex is also learning how to fly and is working on his primary training as a Marine Corps aviator. He flies the T-34c, which he says, "is totally awesome." Alex sends news about several classmates. **Charlie Freeman** is working on an advanced degree in physics at Rochester. According to Alex, "Charlie eats tofu every day and lives in his lab—he even has a small army cot in the lab." **Nate Getrich** finished up at MIT in June and is in California, where he drives a bright red Yugo. **Charlie Pokorny** is at Stanford. **Mike Ting** is at Harvard and is training for triathlons. Alex sends an appropriately inviting message to those of us who remain in colder climes: "Please tell everyone in the class of 1991, if wherever they are is too cold, they can come down here and hang with me in Pensacola."

Let's keep those postcards coming! We are eager to learn about your recent travels, assignments, or activities. Please send mail to: **Andrew Strehle**, secretary, 12 Commonwealth Court # 10, Boston, MA 02135, (617) 232-2261

92

For those of you who were still unsure that we really have finished college, here is our second column of class notes to prove it. Many of us, including myself, have not yet settled into our new position in life as college graduates. Others have easily made the transition and moved onto bigger and better things such as a full-time position in a company or further study in graduate school.

A couple of weeks ago, I saw some of our classmates at a party held by **Paul Kan** at The Crane Club in New York City. I saw **Jeff Jacobson** who is currently attending medical school at NYU, **Dennis Gonzales** who is working at First Boston, and a number of MIT alums from other recently graduated classes. I also heard that **Chrissy Kwon** is attending New York Medical School.

This past week, I had the good fortune to make a trip to MIT for the annual Alumni Leadership Conference. The conference was very informative and helpful for the class officers. Issues we discussed concerned the future of MIT with respect to the Campaign for the future, government support for research universities, and using technology to advance the class connection. Other 1992 class officers in attendance included **Seth Cohen**, who is attending George Washington Law School, and **Roopa Mehendale**, who is working in Philadelphia for Merck Pharmaceuticals. Roopa is living with **Cecelia Linell**, who finished MIT in only three years (an amazing accomplishment I might add). Before moving to the Philadelphia, Roopa spent most of the summer in India. She had a wonderful time, but missed MIT so much that she returned for visits during three weekends.

While visiting MIT, I crossed paths with many of our classmates who are attending graduate school at MIT. Some of those people include **Matt P. Gala, Eric Larson, Izzy Goldwasser, Barbara Sigmund, Courtney Leabourne, Stephan Feldgoise, Jesse Goranson, Alan Peyrat, Christopher Couch, Luis Maas, Susie Ward,** and **Joanna Stone**. Susie is acting as assistant coach to the women's field hockey team. She says that the team is very coachable and has a lot of promise this year even though they lost some very valuable players from the class of '92.

Now for news of particular note. For those of you who did not pick up the September 16 issue of *Tech Talk* or the October issue of *Glamour*, I'd like to inform you that **Joanna Stone** was the first MIT woman to be named one of Glamour's Top Ten College Women. Joanna is among the ranks of some very accomplished women from prestigious universities including Harvard, Yale, Princeton, Barnard, and Brown.

And lastly, this is for you tennis fans whose eyes were glued to the television set during the U.S. Open. Yes, you are right! That was our very own classmate **Kenny Peng** whacking away at the tennis ball on the U.S. Open Reebok Hardcourt commercial. If you have news about yourself or any other classmates, please send it to me. Let's keep the '92 spirit alive.—**Leslie Barnett**, secretary, 56 Brown St., Mineola, NY 11501

COURSE NEWS

I CIVIL & ENVIRONMENTAL ENGINEERING

The Executive Committee of the MIT Corporation has approved a name change for Course I from Civil Engineering to the Department of Civil and Environmental Engineering. MIT's 1992–93 course catalog is the first to carry the new name. "The name change is a reaffirmation of the directions taken by the department over the last 20 years," said **Rafael L. Bras**, '72, SM '74, ScD '75, head of the department. "Civil engineers in their traditional role as people-servers and developers of the infrastructure of progress also have the responsibility for the environment they mold," he said. There are more than 140 undergraduates and 290 graduate students enrolled in Course I under the supervision of 40 faculty members. More than $8 million of research complements and supports the educational endeavor. . . . **Boris W. Boguslavsky**, ScD '38, writes: "At 83, I am still considered useful by the Library of Congress as a civil engineer fluent in Russian for keeping a wary eye on the technical developments in Russia." . . . From Panama City, Fla., **Douglas H. Merkle**, PhD '71, reports: "I just returned from a week at Homestead AFB, viewing the structural and environmental effects of Hurricane Andrew. The observations and recommendations of a team from the Air Force Civil Engineering Support Agency and the Army Construction Engineering Research Laboratory will be published in an AFCESA report."

James V. Hamel, SM '66, of Hamel Geotechnical Consultants in Monroeville, Pa., has been invited to present a special lecture "Environmental Geotechnology in the United States: A Consultant's Perspective" at the International Conference on Environmental Management to be held at the University of Wollongong in Australia in February 1993. He writes: "When not preparing lectures, I keep busy with dams, landslides, landfills, and pursuit of my 3rd degree black belt in Tang Soo Do." . . . **Udaya B. Halabe**, SM '88, SM '90 (XV), PhD '90, writes: "I have been working as an assistant professor in the Department of Civil Engineering at West Virginia University in Morgantown, W.Va., since August, 1990." . . . From Gentilly, France, **Pierre Haren**, SM '79, PhD '80, sends word: "ILOG, where I am directeur general, develops and markets programming environments combining object-oriented programming techniques with software engineering and artificial intelligence. ILOG has built up an offer of modular software components covering many areas of advanced application programming. The corresponding development tools are used in all development stages, from conceptual modeling to final delivery of C-compiled applications." . . . General **Joseph P. Franklin**, SM '61, reports from Swanton, Md.: "I retired from the U.S. Army in 1987 as a major general (commandant of Cadets at USMA West Point 1979–82). I was chief of the U.S. Military Mission in Spain from 1983–87. I then founded a business consulting company in Madrid called Franklin SA, which specialized in U.S. investments and joint ventures in Spain. In October 1992 I was named special consulant to the board of directors at Frequency Electronics, Inc., in Mitchel Field, N.Y."

From Anderson, S.C., we receive word from **M. David Egan**, SM '66: "I was awarded the ACSA Distinguished Professor Medallion for sustained creative achievement in the advancement of architectural education by the Association of Collegiate Schools of Architecture (ACSA) on March 16, 1992, in Orlando, Fla. ACSA is the membership association representing over 3,500 architectural faculty members at 150 schools in North America." . . . **James F. Lenney**, PhD '47, writes from Honolulu, Hawaii: "My postdoctoral fellow, Mel Jackson, and I have discovered a new metabolic pathway for the formation of gamma-aminobutyric acid. We have localized this system in certain specific neuronal tracts in the human brain and retina." . . . From Paris, France, **Eric F. Peyrard**, SM '82, writes: "I'm still at IBM and enjoying it. I have a new job as product manager for IBM France's line of electronic documentation software. I'm responsible for marketing the IBM solutions to all French customers and finding new products to add to our catalogue. In the exploding market of hypertext and SGML, it's a fun job." . . . Word from **Gustavo A. Jaramillo-Rego**, SM '69, CE '74, in Bogota, Colombia: "I was professor at Universidad de Los Andes School of Engineering from 1974–77, and then visiting professor at the Ministry of Public Works in Caracas, Venezuela. From 1978–80, I was president of Ingenio Sarkara; the following two years.I was dean of the School of Engineering at Universidad de Los Andes. And from 1984 to date, I have been president at Inversiones Jaramillo Velez."

Kevin J. Phillips, SM '73, ENE '73, writes from Northport, N.Y.: "As president of Fanning Phillips & Molnar, I have acquired North Atlantic Laboratories, specializing in indoor air quality, industrial hygene, and asbestos." . . . **Peter P. Macke**, SM '83, CE '85, reports: "I got married in November of 1991 and moved into a new home in the suburbs of Frankfurt, Germany. I am a VP in Citibank's Real Estate Germany Division for the developing of large commercial property." . . . **Thomas F. Gilbane, Jr.**, SM '75, executive VP at Gilbane Building Co. in Providence, R.I., has been named to the New England Telephone's board of directors. . . . **Olivia "Libby" Reyes**, SM '88, PhD '91, received the Rocha Medal 1993. This medal is given to the best PhD thesis in rock mechanics and is based on a two-stage evaluation. First a regional panel of experts (in her case, North America) reads and ranks the theses. The two top-ranked theses of each region are then read by an international panel and ranked again. It is considered the most prestigious award that a young rock mechanics researcher can receive.



Leonard Albano

Leonard D. Albano, PhD '92, has been named assistant professor of civil engineering at Worcester Polytechnic Institute in Worcester, Mass. His research interests are in the areas of structural engineering, design theory, integration of design and construction, and design of large-scale constructed systems. . . . For his PhD thesis, **Garry Willgoose**, SM '87, PhD '89, is the recipient of the 1989 Lorenz G. Straub Award, named for the founder of the St. Anthony Falls Hydraulic Laboratory at the University of Minnesota. Willgoose is the 24th winner of the Award and the sixth winner from MIT. The Straub Award, which includes a medal and $2,000 prize, is given to the author of a meritorious thesis in the area of hydraulic engineering. Willgoose is currently a lecturer in the Department of Civil Engineering and Surveying at the University of New Castle in Australia, his home country.

Walter Steiner, SM '77, ScD '80, received the Pergamon Press Award for the best paper (out of 82) at the EUROCK Symposium. The paper deals with design of tunnels in swelling rocks. . . . **Peter J. Sherman**, SM '86, has joined Lockwood Greene Engineers to work for the firm's international subsidiary, Lockwood Greene International. Fluent in Spanish, he will be involved in the company's business development in Mexico and other Latin American markets. Previously, Sherman was VP for new business and construction management at Sherman & Son Construction Co. . . .



Peter Sherman

Avery H. Demond, '80, SM '83, assistant professor in the Department of Civil and Environmental Engineering at the University of Michigan, has been awarded an Environmental Restoration and Waste Management (ER/WM) Junior Faculty Award sponsored by the U.S. Department of Energy's Office of ER/WM. Administered by the Oak Ridge Institute for Science and Education, the program's objective is to increase the number of university/college and technical-school faculty members and students who conduct educational development, technology development, and research in the ER/WM area. For his research proposal, "Manipulation of Wettability for Enhanced Removal of Organic Liquid Contaminants from the Subsurface," Desmond received a first-year award of $50,000. Awardees are expected to maintain contact and collaborate with DOE facilities, and Desmond will collaborate with Pacific Northwest Laboratories in Richland, Wash.



James Becker

James M. Becker, Course I senior lecturer and president of Beacon Construction Co. in Boston, has received the 1992 Award of Merit for Planning and Development from the American Underground-Space Association. He was cited by the Minneapolis-based organization for his successful integration of underground space into several significant urban projects in the Boston metropolitan area, including Rowes Wharf and 75 State Street. Of special interest to the association was Becker's involvement in the Post Office Square project. An old, inefficient surface parking facility was replaced by a larger underground parking facility and now features an elegant park and a much-needed green space in the heart of Boston's financial district. . . . Course I Professor **Yosef Sheffi**, PhD '78, is a cover boy! His photograph,

against the backdrop of the MIT dome, adorned the cover of the July 16 issue of *Purchasing* magazine, heralding a story on the growing importance of logistics to strategic supply management. The magazine's 1992 "Transportation Report" included a description of the MIT Center for Transportation Studies, which Sheffi directs. . . . Professor **Moshe Ben-Akiva**, SM '71, PhD '73, of Course I's Transportation Systems Division, has been given an honorary degree, Doctor Honoris Causa, from the Université Lumière Lyon of Lyon, France, in recogntion of his contributions to transportation research.

The Association of Alumni and Alumnae has been notified that **John W. Pocock**, SM '39, of Winnetka, Ill., died on October 19, 1992. No further information was provided.

II MECHANICAL ENGINEERING

From London, **John Stopford**, SM '62, writes: "Thirty years on, it seems strange to write as a Course II grad about my work in international relations and management. For years now, I have been teaching at the London Business School in international business. Part of my work involves advisory projects in developing countries—a base of experience that prompted me to collaborate with a leading expert in international relations. We both needed to understand more fully how diplomacy and business were each affecting the other. The result was a book, *Rival States, Rival Firms* (CUP, 1991), that has just won the 1992 George R. Terry Book Award from the (American) Academy of Management."... **Ashok B. Boghani**, SM '71, ME '73, ScD '74, reports from Acton, Mass.: "I am now director of the worldwide practice in transportation at Arthur D. Little."... **Michael Larson**, PhD '92, has accepted an appointment as assistant professor in the Department of Mechanical Engineering at Tulane University in New Orleans, La. . . . From Cleveland, Ohio, **Robert Siegel**, ScD '53, of the NASA Lewis Research Center, sends word: "In September 1992, the third edition of *Thermal Radiation: Heat Transfer* (Taylor & Francis) was published."

News from **Roy Rayle**, SM '49, of San Antonio, Tex., arrived in a specially stamped envelope: "Notice my stamp honoring Theodore von Karmen. I was honored to meet him at a reception in Paris in 1960, where I had to report on European diesels for the Army; before then only Navy could use. He spoke highly of Professor Tsien Hsue-shen, SM '36 (XVI), my thesis advisor on the subject of why U.S. bombs had such poor shape and accuracy was lost when dropped from high altitude. My final thesis was under Professor Shapiro on orifice geometry, for Professor Taylor and Jacob den Hartog. After 20 years in Army R&D, plus 20 as engineering director in the Mid-West, I retired to San Antonio, where I teach dynamics part-time in a local college and write history and heritage articles for the local chapter of ASME. I visited the Greek Islands this summer with my brother, who had sailed the Atlantic in a 50-foot sailboat in the summer of 1991."... **Alexander K. Tziranis**, SM '92, writes: "I am now back in Greece trying to spend as little time as possible in the Greek Army!" ... **William L. Verplank**, SM '67, PhD '77, reports: "I have joined a new venture, Internal Research Corp. in Palo Alto, Calif."... From Chestnut Hill, Mass., **S. M. Salomon**, '50, sends word: "After 31 years with Bird Machine Co. (a division of Baker-Hughes, Inc., since June 1989) in South Walpole, Mass., I have joined the unemployment ranks! Specialty: Centrifuges, filters, separation of liquid/solids. My last function was as a senior scientist. I am looking for consulting situations!"

John C. Chato, PhD '60, writes from Urbana, Ill.: "I have been awarded the 1992 H.R. Lissner Award from ASME, given annually to recognize outstanding achievement in bioengineering. The citation reads, in part: for 'pioneering contributions to the development of the field of bioheat transfer, including numerous landmark research advances, and for exceptional leadership in mentoring a subsequent generation of investigators.' I was elected to the executive committee of the Bioengineering Division of ASME. This four-year duty will include one year as chair."... **William P. Teagan**, SM '63, ME '66, PhD '67, reports: "I am VP of Arthur D. Little, Inc., and manage energy sector technology assessment activities. My recent focus is on the role of fuel cell technology in allowing the increase in delivery of energy service consistent with environmental constraints."... From Fairfax Station, Va., **Walter S. Szczypinski**, SM '66, sends word: "I retired from the Navy in November 1984. I am executive VP of Techmatics, Inc., an engineering services company in Arlington, Va., which I joined in 1984 in its second year (19 employees, $2M revenue). I helped lead growth to current 400 employees and just under $30M revenue and 3 years on *Inc.* 500 list of fastest growing companies in United States."

Capers W. McDonald, SM '76, writes: "I'm happy to provide friends and associates from the 'Tute with the following update. I have become president & CEO of Microbiological Associates, Inc., of Rockville, Md. The company provides biological safety testing services to pharmaceutical, biotechnology, and personal-care-products companies. They have also safety tested moon rocks and many first-of-their-kind products, including the first licensed therapeutic monoclonal antibody, first recombinant protein manufactured in tumorigenic mammalian cells, first genetically engineered microbial pesticide, first gene-therapy products approved for clinical trials, first biopharmaceuticals from insect cell systems, and first polio vaccines. My former post was as president of Spectroscopy Imaging Systems Corp. in Fremont, Calif. My wife, Marion, and I are in the process of returning to the Atlantic from the Pacific Coast after enjoying 15 fast and fruitful years among the quakes, wildfires, mudslides, and career changes of the West. Son, Adam ('10 ?), was born in San Francisco but will adapt."... Major **Michael R. Helmick**, SM '88, sent word in October: "After completing a three-year assignment as associate professor of mechanical engineering in the Department of Civil & Mechanical Engineering (formerly Department of Mechanics) at the U.S. Military Academy at West Point, and the birth of our first child, Stephanie, Gina and I spent this past year at the Command and General Staff College in Kansas. I completed my work toward a master's degree in military arts and sciences and was promoted early to major. We have since moved to Fort Hood, Tex. I am now a war plans staff officer and Gina is expecting our second child in January 1993."

Thomas R. Kurfess, '86, SM '87, SM '88 (VI), PhD '89, assistant professor at Carnegie Mellon University in the Departments of Mechanical Engineering and Engineering & Public Policy, has been awarded a 1992 National Science Foundation Young Investigator Award. The awards finance research of faculty members near the beginning of their careers. . . . **Thomas J. Overcamp**, SM '70, ME '71, PhD '73, has been awarded the Lyman A. Ripperton Award by the Air & Waste Management Association for distinguished achievement as an educator in the field of air pollution control. He was also elected to its board of directors. He is a professor of environmental engineering at Clemson University. . . . **Frederick Berretta**, '79, SM '80, has joined the La Jolla, Calif., firm of Scalone Stipanov Yaffa & Mebane as an associate. He will practice in the firm's Litigation and Corporate Law Group. Berretta most recently served as an in-house counsel for National Health Laboratories, Inc., in La Jolla.



Thomas Overcamp

Bruce Skinner, SM '65, has been appointed dean of the College of Engineering at the University of Bridgeport in Connecticut. Skinner's career has focused on education and administration in a variety of ocean engineering areas. During his Coast Guard career, he has been assistant engineering officer on two cutters, commanding officer of a LORAN navigation station in Alaska, and a naval architect at Coast Guard headquarters in Washington. Returning to the Coast Guard Academy, he taught a variety of ocean engineering subjects as well as physics and computer science. Skinner retired from the Coast Guard with the rank of captain in 1990 after 31 years of service. . . . Navy Lieutenant Commander **Mary Townsend-Manning**, SM '87, recently graduated from the Submarine Officer's Basic Course in the Navy. During the 12-week course at the Naval Submarine School in Groton, Conn., students are taught the theory, construction, and operation of nuclear-powered submarines. In preparation for their first submarine assignment, students receive instruction on shipboard organization, damage control, submarine safety, and escape procedures. . . . **Paul P. Daulerio, Jr.**, SM '70, has been named general manager of International Aviation-Fuel Sales at Texaco, Inc., in White Plains, N.Y. Previously, he was assistant to the VP at Texaco.

MIT Professor **John B. Heywood**, SM '62, PhD '65, has been appointed the first holder of the Sun Jae Professorship of Mechanical Engineering. Heywood is widely known for his outstanding contributions to the research areas of energy, engines, combustion, power and propulsion, and transportation. The chair was established in 1991 by the Daewoo Heavy Industries of Korea to recognize the joint concern of both Daewoo and MIT with the advancement of teaching and research in the areas of automotive and manufacturing engineering. In addition, this professorship provides a permanent memorial and reminder of the legacy of Sun Jae Kim, the son of the chair of Daewoo. Sun Jae Kim was a Course II master's degree candidate when he was killed on November 21, 1990, in an automobile accident. Sun Jae Kim demonstrated that someone with a background in psychology could not only succeed but excel in engineering in the rigorous MIT environment. It is hoped that Sun Jae's experience will lead others to choose to work at the interface of disciplines, and that this professorship will serve as a source of inspiration for that approach. Heywood's research has centered on the design and operating characteristics, and fuels requirements, of automotive and aircraft engines. A major emphasis has been on developing models to predict the performance, efficiency, and emissions of spark-ignition and diesel engines, and in carrying out experiments to evaluate these models.

Course II Professors **Neville Hogan**, SM '73, ME '76, PhD '77, and **Derek Rowell** have been appointed director and co-director of the Eric P.('32 (XV)) and Evelyn E. Newman Laboratory for Biomechanics and Human Rehabilitation. They succeed **Robert Mann**, '50, SM '51, ScD '57, who had headed the lab since its inception in 1975. In addition, research scientitst and lecturer **Michael J. Rosen**, SM '71 (XIX), SM '81 (XV), also of Mechanical Engineering, has been appointed director of the Rehabilitation Engineering Research Center within the Newman Lab. The Newman Lab is one of the largest Course II labs. Its mission is to educate mechanical engineering students through leading-edge research to understand and augment human performance. The research conducted there concentrates on fundamental studies of the biomechanical and neural bases of human sensory and motor behavior that are applied to design technology to rehabilitate humans with sensorimotor deficit. Hogan holds a joint appointment in Course IX. His research interests are in robotics and neural control for contact tasks and tool use. Applications include telerobotics, haptic virtual environments, and human performance enhancement technologies. Rowell joined the faculty in 1976. His research areas encompass the development of assistive systems for the handicapped, including the blind, stutterers, and the nonvocal; biomechanics, medical

imaging, and image processing; biomechanics, instrumentation and hardware/software system design. Rosen, a principal research scientist and lecturer, has been with the department since 1975. His research interests center on human motor dysfunction, computer-based systems for assessment and clinical decisions, assistive technology for disabled people, and concurrent engineering.

David P. Hoult, '57, has been appointed co-director of the new MIT Manufacturing Institute. Hoult has been associated with the Department of Mechanical Engineering since 1976 as a senior research associate. He was a faculty member in the department from 1967–75, when he left MIT to found a consulting company in high-technology engineering and products in the auto industry. The Manufacturing Institute is an academic/industrial collaboration designed to facilitate the development of manufacturing research into real manufacturing practice. The Institute will serve as an R&D and teaching organization for engineering students. It received initial funding from the NSF and is presently pursuing additional funding throught a recruitment program of industrial partners. The administration of the Manufacturing Institute also includes Professor Nam P. Suh, '59, SM '61 (II), department head of Course II and co-director of the institute, and Andre Sharon, SM '84, PhD '89 (II), executive officer. Sharon is a Course II lecturer and an associate director of the Laboratory for Manufacturing Policy.

Captain **Edward M. Day**, SM '40, of Bethesda, Md., died on October 19, 1991. Day retired as a Navy captain in 1961 after having served as inspector general of the Bureau of Ordnance and the Bureau of Weapons. During the 1930s, he served aboard destroyers and then was torpedo officer of the light cruiser *Memphis* for four years. He was a torpedo specialist on the Pacific Fleet staff and then at the torpedo station at Newport, R.I. Later duty included command of a naval operating base in Greenland, command of a transport division and an amphibious force in the Atlantic, and service at the Pentagon. He was commander of the ammunition ship *Mt. Katmai* in the Pacific, then served at the Naval Research Lab and as chief of staff of a service squadron in the Pacific before his appointment as inspector general. After retiring from the Navy, Day worked 10 years for McDonnell Aircraft Corp. as resident representative of the Westinghouse Air Arms Division in Baltimore, until retiring again in 1970.

Wayland S. Bailey, '19, of Norwell, Mass., died September 4, 1992. He was 96. A sargeant in the Army during World War I, Bailey then taught at Lehigh and the University of Connecticut before taking an appointment at Northeastern in 1937 and returning to live in Norwell the same year. Bailey also taught at MIT and Norwich University. He retired from teaching in 1957 and entered upon a career as a practicing engineer, first with Bethlehem Steel Corp. at the Fore River Shipyard in Quincy, Mass., and then with the Bechtel Corp. and with Arthur D. Little Co. He worked full-time until past the age of 80. . . . The Association of Alumni and Alumnae has been notified of the following deaths: **Harold M. Coverdale**, SM '47, of Laguna Hills, Calif., on September 28, 1992; and Colonel **Edward C. Reber**, SM '34, of Chambersburg, Pa., in 1988. No further information was provided.

III MATERIALS SCIENCE AND ENGINEERING

From nearby, **Ibrahim Ucok**, ScD '91, reports: "I have been a postdoctoral associate in the Department of Materials Science and Engineering at MIT since graduation." . . . In November we received word from **Edmund H. Moore**, SM '87: "I'm looking forward to graduating with a PhD in materials science and engineering from the University of Florida at Gainesville in December 1992." . . . From Arlington, Va., **William S. Coblenz**, SM '77, PhD '81, writes: "I am completing my second year at the Defense Advanced Research Projects Agency (DARPA) where I manage the structural ceramics program." . . . **Claude Lupis**, ScD '65, reports from Sydney, Australia: "I am principal of Claude Lupis & Associates Pty. Ltd., consultants in mining and metallurgy. The company performs technical and economic evaluations of projects or operations for a wide variety of metals and minerals, as well as feasibility studies, including calculation of ore reserves, process flow sheets, and market surveys. It advises and assists in the technical and economic development of assets. In addition, it represents several American and European companies in Australasia and negotiates, on their behalf, sales and joint venture agreements." . . . **George Krauss**, SM '58, ScD '61, sends word: "I was made the John H. Moore Professor of Metallurgical and Materials Engineering at the Colorado School of Mines in September 1992. I was also awarded a Japanese Senior Fellowship for a research visit to Japan in November/December 1992 and awarded/delivered the Colorado School of Mines Senate Distinguished Lectureship in October 1992."

Svante Prochazka, SM '68, writes from Ballston Lake, N.Y.: "Interest in diamond as a material is increasing dramatically on all fronts of its application and therefore I have focused my 20 years of expertise in consolidation of covalent solids to sintering of diamonds. Sintering of diamonds was invented at GE R&D 25 years ago and resulted in a line of products such as components for drill bits for rock drilling and wire dies. Expansion of the business depends on further improvement of the manufacturing process and product properties, a challenging task for a small group of researchers headed by me at GE in 1992." . . . From Chiba, Japan, **Yukio Kuroda**, SM '87, reports: "After I graduated from MIT, I rejoined Nippon Steel Corp. In my present job as a superintendent of a galvanizing mill in Kimitsu Works, I have met a lot of foreign visitors and some of them were alumni of MIT. Whenever I met those people, we talked about MIT, Boston, and the U.S.A. MIT is my home Institute and Boston is my home town. . . . **Anil R. Chaudhry**, SM '83, reports: "I have just completed two years as the technology transfer manager for the Edison Materials Technology Center (EMTEC) in Dayton, Ohio. This has been the most rewarding job I've had since graduating. I am learning and developing better ways to take materials and processing technologies from the R&D phase to the industrial applications and the commercialization phase."

From Cohasset, Mass., **John Zotos**, SM '56, MTE '67, sends word: "I've been a professor of mechanical engineering at Northeastern University in Boston, where I retired from active teaching and research on June 30, 1992. I've been known worldwide as the 'Father of Computer Metallurgy' since appearing on the cover of *Iron Age* magazine on September 5, 1963. My paper entitled 'Computers Open New Horizons in Casting Technology' was selected as the 'American Exchange Paper' for the International Foundry Congress in Amsterdam, The Netherlands, in September 1964. I have written many technical papers and several books, and serve as an independent consultant." . . . **Michael A. Christie**, PhD '78, has been named VP of process development in the Therapeutic Division at Zynaxis, Inc., in Malvern, Pa. Previously he was associate director of Smith Kline Chemicals at Smith Kline Beecham Corp. in Conshohocken, Pa. . . . "Myths and Realities of Higher Education: Opening of the American Mind," by **Diran Apelian**, ScD '73, appeared in the summer 1992 issue of *The Bent of Tau Beta Pi*. Apelian is provost and the Howmet Professor of Engineering at Worcester Polytechnic Institute

Thomas M. Harris, SM '87, PhD '87, professor in the Department of Chemistry at the University of Tulsa, has been awarded an Environmental Restoration and Waste Management (ER/WM) Junior Faculty Award sponsored by the U.S. Department of Energy's Office of ER/WM. Administered by the Oak Ridge Institute for Science and Education, the program's objective is to increase the number of university/college and technical school faculty members and students who conduct educational devel-

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opment, technology development, and research in the ER/WM area. The proposals were selected on a competitive basis; for his proposal, "Heavy Metals Extraction," Harris will receive a first-year award of $50,000. Awardees are expected to maintain contact and collaborate with DOE facilities. Harris will collaborate with Savannah River Laboratory in Aiken, S.C. . . . **Katayun Barmak**, SM '85, PhD '89, has been named an assistant professor in the Materials Science and Engineering Department at Lehigh University in Bethlehem, Pa. Barmak, who specializes in thin film reactions, was a staff engineer at IBM's T.J. Watson Research Center and IBM East Fishkill. . . .



Michael Prengaman

Michael E. Prengaman, SM '84, has been named general manager of roller and cage manufacturing at the Timken Co.'s Gambrinus Roller Plant in Canton, Ohio. Prengaman joined the company in 1977 as a metallurgical trainee. Since then he has held several managerial positions, his most recent as manager of green and forming. . . . **Michael J. Wargo**, '73 (XII), ScD '82, a research associate at the Materials Processing Center currently on leave at NASA, was chosen by the NASA Select Cable channel to host a daily half-hour show on a recent shuttle mission. For 13 days—the duration of the Microgravity Lab I mission—Wargo explained the experiments aboard the spacecraft and what was accomplished by the astronauts each day. The show was broadcast out of the Marshall Space Flight Center in Huntsville, Ala., for a general audience.

Robert L. Coble, ScD '55, of Arlington, Mass., died on August 27, 1992. The Course III professor emeritus was widely known for his research into the properties of ceramics. Coble's studies on sintering, while at the General Electric Research Laboratory in Schenectady, N.Y., before he came to MIT, led to the development of "Lucalox," a dense aluminum-oxide ceramic used in the sodium-vapor highway lamps that give off an orange glow. Sintering is the process that causes material to become a coherent mass by heating without melting. The new ceramic transmitted light, withstood high temperatures, and could be pressed into any shape desired. His research and teaching at MIT focused on physical ceramics and the kinetics of ceramics processes. In 1960 he was appointed to the MIT faculty as an assistant professor of ceramics in the Department of Metallurgy, now the Department of Materials Science and Engineering. He became associate professor in 1962 and full professor in 1969, retiring in 1988. His honors include election to the NAE in 1978. He was a Fellow of the American Ceramic Society and a member of the Ceramic Education Council and the National Institute of Ceramic Engineers. . . . The Association of Alumni and Alumnae has been notified that **Will Mitchell, Jr.**, '46, of Egg Harbor, Wisc., died on April 27, 1992. No further information was provided.

IV ARCHITECTURE

From New London, N.H., **George B. Thomson**, '49, sends word: "Thus far, the year has been highlighted by: 1) A trip to Indiana for ground-breaking at Thomson Consumer Electronics (GE & RCA TVs, VCRs, etc.); 2) 50th reunion at Harvard; 3) 50th wedding anniversary; and 4) Installation of son-in-law as federal judge. Thomson Electronics is named for my grandfather, Elihue Thomson, who served as acting president of MIT and was a GE founder." . . . **Eric Mumford**, MAR '83, writes: "I am teaching the 'History of the American City' course in the Columbia University Graduate School of Architecture, Planning and Preservation. I received my architectural license in 1986 and am presently completing a PhD in the history of urbanism at Princeton University." . . . **Gordon Stephenson**, MCP '38, reports from Claremont, Australia: "My book has recently been published by Fremantle Arts Centre Press. Entitled *On A Human Scale: A Life in City Design*, it recounts my experience during 60 years in architecture and planning in the United Kingdom, USA, Canada, and Australia. The distributor in North America is International Special Book Services in Portland, Ore." . . . **John Bullard**, MAR '74, writes: "Having served six years as the mayor of New Bedford, Mass., I now work at the New Bedford Seafood Co-op. I work with commercial fishermen to develop fishery management plans that protect both the resource and the traditional fishery."

Steve Imrich, MAR '80, reports: "I have recently completed work on the Tennessee Aquarium in Chattanooga, Tenn. I worked as the project architect for this $45-million facility which is now the largest fresh-water aquarium in the world. The aquarium focuses on the Tennessee River system from its head waters in the Appalachian mountains to its outlet in the Gulf of Mexico. The aquarium also interprets comparative rivers from around the world, including the Zaire and Amazon. Articles describing the aquarium have been published recently in various journals including *Architecture*, *Popular Science*, and the *World Monitor*. I am currently an associate with Cambridge Seven Associates in Cambridge. . . . **Rod Brana**, SM '85, SM '86, sends word: "I recently joined Federal Realty Investment Trust. The company specializes in acquiring, renovating and operating shopping centers. I live with my wife, Monica, and three-year-old son, Nicholas, in McLean, Va.—a suburb of Washington, D.C. . . . An update from **Kurt Eichenberger**, MAR '82, in Raleigh, N.C.: "My architecture firm continues to grow despite the recession. Recent projects include renovation to the NCSU Student Center and the design of a transitional housing facility for the homeless. We have also recently been awarded a commission to convert a downtown building in Raleigh for use as an SRO for homeless women including those with AIDS."

From her other alumnae publication, we learn that **Ann Beha**, MAR '75, is a Boston architect specializing in planning and design for landmarks, museums, and academic institutions. Since establishing her firm, Ann Beha Associates, 15 years ago, she has worked on projects including Jordon Hall at the New England Conservatory of Music, the Isabella Stewart Gardner Museum, the Portland (Maine) Museum of Art, and Wellesley's French House. With work extending beyond New England to Florida, Kentucky, New York, and Tennessee, the award-winning firm is known for integrating new design and technology into historic structures. She and her husband, investment advisor Robert Radloff, live on Beacon Hill in Boston with their two daughters. . . . **Sally Sweetland**, MAR '86, recently held an exhibit at the Woodstock Gallery of Art in Vermont. Fifteen pieces appeared in the "Intimate Places" exhibition. Sweetland lives in Warren, Vt., where she supports herself as an artist and book illustrator. . . . *Office Design* (Whitney Library of Design, 1992), is a new book by **Peter B. Brandt**, '60. The book "explores the complete process of office design from the initial marketing of professional services to the final move-in and project follow-up," according to its book jacket. Brandt is currently in private practice and teaches contract interior design at the New York School of Interior Design. He was formerly a VP and managing principal with Gensler and Associates/Architects.

Jennifer K. Shakespeare, MAR '77, of Provincetown, Mass., died on September 13, 1992. Since 1981, Shakespeare was a co-managing partner, architect, land-use planner, and historic preservation panelist for the Design Associates of Nantucket & Cambridge. For 12 years, Shakespeare and the Design Associates were the architectural team for *This Old House*, a nationally syndicated production of WGBH-TV Boston. A number of the firm's projects—both historic preservations and new projects—were covered by magazines such as *House & Garden*, *House Beautiful*, *Home*, *Cape Cod Life*, *Cape Cod Home & Garden*. She was a founding member of the Boston Society of Architects' Growth Management Committee and served on the board of directors of Independence House, Cape Cod's only free service for battered women and children and sexual assault survivors. Prior to her work at Design Associates, Shakespeare was employed at a variety of architectural firms in New York City and Baltimore—most notably, RTKL Associates architecture and planning firm with whom she helped revitalize the Baltimore downtown and waterfront districts. She was an active member of the Boston Society of Architects, the American Institute of Architects, the National Trust for Historic Preservation, and the Society for the Preservation of New England Antiquities.

V CHEMISTRY

Clarence A. Johnson, PhD '39, writes: "I am now fully retired. I enjoy golf and swimming. My daughter, Elsa, teaches at the American University in Cairo. My son, Karl, is a marine botanist with the Harbor Authority in Auckland. Would like to hear from fellow alumni—3415 Par Rd., Sebring, Fla., 33872-1228." . . . **Mark A.K. Patterson**, PhD '82, reports: "I recently finished my pediatric residency at the University of Virginia at Charlottesville, and moved to Montgomery, Ala. I was also promoted to major (USAF) and am working as a staff pediatrician at Maxwell Air Force Base." . . . **Mark Nodine**, SM '82, writes: "I've just handed in my dissertation for a PhD in computer science at Brown University. My wife, Marian Stein Nodine, '80, SM '81, and I have two children. Timothy, almost 5, and Anna, 2. Marian is in the final year of a PhD program in computer science at Brown. I am now working for the Motorola Cambridge Research Center in Kendall Square as a research scientist." . . . **Ed Kosower**, '48, who holds the Josef Kryss Chair of Biophysical Organic Chemistry at Tel Aviv University, is one of three authors of a text, *Introduction to Organic Chemistry* (Macmillan, 1992). The book is being used at Harvard, Yale, Columbia, Brown, and Stanford, and is considered the premier text of organic chemstry.



John Hopps, Jr.

John H. Hopps, Jr., SM '61, a principal member of Draper Lab's technical staff, has been selected to direct the National Science Foundation's Division of Materials Research (DMR) of the directorate for mathematical and physical sciences. His new duties began on September 1. As director of material research, Hopps oversees grants in the areas of metals, ceramics, and electronic materials; materials theory; condensed matter physics; and solid-state chemistry and polymers. In addition, DMR is responsible for NSF's Materials Research Laboratories and Materials Research Groups; several science and technology centers, such as the Center for Superconductivity at the University of Illinois; and national facilities, such as the NSF-funded National Magnet Laboratory at Florida State. Hopps joined Draper in 1977 from Ohio State University, where he was serving as assistant professor of physics. Prior to his current position, Hopps was chief of photonics technology, manager of Draper's laser R&D facility, and manager of energy programs development at Draper. He also currently serves as a research affiliate in the Microsystems Technology Laboratory at MIT. Hopps' recent interest has been in quantum well photonic devices. He was previously instrumental in developing and implementing programs for the application of fault-tolerant control systems to research nuclear reactors and commercial power

All in the Family



Melinda M. Hall, PhD '85 (XII), Susan A. Hall, SM '82, PhD '92 (VI), and Leslie A. Hall, PhD '89 (VI), (l to r) made MIT history last spring when Susan earned the Hall family's third MIT PhD. Susan, who gave birth to her second child two days after defending her thesis, spent the last few months at home with her kids and is now looking for an academic position around the Boston area. Her husband, David Bass, SM '81, ScD '83 (X), is an environmental engineer at Ground Water Technology, Inc., in Norwood, Mass.

Melinda is an associate research scientist at Woods Hole Oceanographic Institution, where she earned a doctorate through the joint program with MIT. Her husband, Larry Pratt, PhD '82 (XII), also a scientist at Woods Hole, received a doctorate through the same program. Leslie, the youngest Hall, is an assistant professor in the Department of Civil Engineering and Operations Research at Princeton University; she broke family tradition by marrying a Harvard Law School graduate.

Not surprisingly, the sisters credit their parents with inspiring their achievements. "I guess my father (Robert Hall) instilled the love of scientific work in all of us," Susan says. "He taught us math when we were very young, just made it fun for us. My mother (Helen Martin, who still resides in McLean, Va., where the trio was raised) also has a natural bent for numbers—she has a degree in accounting. Of course, there were no boys in the house. Had there been boys, my father might have pushed them toward science instead of us." Mr. Hall, who held a doctorate in physical chemistry from Ohio State University, never got to see the fruit of his teaching; he died in 1976.

You wouldn't expect members of such an talented and motivated family to study with "just any Tom, Dick, and Harry." Indeed, *this* Tom, Dick and Harry were carefully chosen: Thomas L. Magnanti, the G. Eastman Professor of Management Science at the Sloan School, was Leslie's advisor; Richard C. Larson, '65, SM '67, EE '67, PhD '69, a professor in Course VI, was Susan's; and Harry L. Bryden, a senior scientist in the Department of Physical Oceanography at Woods Hole, was Melinda's. □

systems.

Stephen E. Cabaniss, '80, assistant professor of chemistry at Kent State University, has been awarded an Environmental Restoration and Waste Management (ER/WM) Junior Faculty award sponsored by the U.S. Department of Energy's Office of ER/WM. Administered by the Oak Ridge Institute for Science and Education, the program's objective is to increase the number of university/college and technical school faculty members and students who conduct educational development, technology development, and research in the ER/WM area. The proposals were selected on a competitive basis and Cabaniss' proposal, "Colloid and Particle Size Effects on Contaminant Speciation," earned him a second-year renewal for $50,000. Awardees are expected to maintain contact and collaborate with DOE facilities, and Cabaniss will collaborate with Oak Ridge National Laboratory in Tennessee. . . . **Petra Turowski**, PhD '90, has been named an assistant professor of chemistry at Smith College in Northampton, Mass. . . . **Russell F. Trimble**, '48, PhD '51, has retired as a chemistry professor after 38 years at Southern Illinois University at Carbondale. He joined SIUC in 1954 as an assistant professor. He was promoted to associate professor in 1962 and to professor in 1971. He often taught summer institutes for high school biology teachers and top high school students. He served in the U.S. Navy from 1945–46.

Carl H. Brubaker, Jr., PhD '52, of Okemos, Mich., died on September 24, 1992. Brubaker joined the faculty at Michigan State University in 1952 and became a professor in 1961. Among the many appointments he held was as associate editor and member of the board of editors for the *Journal of American Chemical Society*, through 1989. Michigan State presented Brubaker "The Distinguished Faculty Award" in 1980.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Marian Stein Nodine, '80, SM '81, is in the final year of a PhD program in computer science at Brown. Her husband, Mark Nodine, SM '82 (V) just handed in his dissertation for a PhD in computer science at Brown. They have two children. Timothy, almost 5, and Anna, 2. Mark is now working for Motorola Cambridge Research Center in Kendall Square as a research scientist. . . . From Pittsburgh, **Daniel N. Jackson**, SM '88, writes: "I finished a PhD in June 1992, and will be starting as an assistant professor of computer science at Carnegie Mellon this fall. My wife, Claudia, gave birth on August 27, 1992, to a baby daughter, Rachel." . . . Word from **Al J. Gasiewski**, PhD '89: I am an assistant professor in the School of Electrical Engineering at Georgia Tech in Atlanta. I'm an HP Faculty Development Fellow and completed a PhD thesis in atmospheric remote sensing under the guidance of Course VI Professor **David H. Staelin**, '60, SM '61, ScD '65. Since arriving at Georgia Tech in January, 1989, I have led the development of passive submillimeter-wave sensing of the troposphere. I'm currently performing innovative measurements contributing to new methods for passive remote sensing of ocean waves. I developed Georgia Tech's version of the MIT UROP, and I'm active in a variety of other NASA/EOS-related projects."

From Sunriver, Ore., **Wilbur B. Davenport, Jr.**, SM '43, ScD '50, writes: "I return to Hawaii in the spring of 1993 to teach again at the University of Hawaii at Manoa. (EE441—Statistical Communications). Joan goes back with me to again be a docent at the Honolulu Academy of Arts." . . . **Walter T. White**, SM '39, ScD '41, reports: "My wife, Margaret Ann, and I moved from Walpole, N.H., in June of 1992, to Tryon Estates, a life-care retirement community in Columbus, N.C. We have a three-bedroom apartment with beautiful views of Western North Carolina." . . . **Wesley W. Pendleton**, SM '40, sends news from Muskegon, Mich.: "On July 22 we attended a picnic for our park in Zephyrhills, Fla. 185 people were there (mostly Michigan-based members like us). However, some came up from Florida and made the picnic part of their trip. The park has 600 people during the height of the season. We look forward to the MIT Florida reunion scheduled for January 4–7, 1993, in Naples. Being Floridians at this time period, we plan to make the short trip to Naples on the 3rd. This reunion was conceived by the class of '40, but has been opened up to other classes and any Florida MIT grads." . . . **Hongtao Zhang**, PhD '90, is living in Austin, Tex.

From Half Moon Bay, Calif., **Walter Hamscher**, SM '83, PhD '88, writes: "I am a research manager at the Price Waterhouse Technology Centre in Menlo Park, Calif., directing projects in the use of artificial intelligence techniques in financial applications. My son, Peter, is now three years old and a real devil." . . . **Yoshihisa Hara**, SM '91, reports from Yokohama, Japan: "I'm working for Mitsubishi Electric Corp., and engaged in the R&D of radar signal processors. The experiences I have had at MIT give much help to me. I got married last year and my wife gave birth to a baby in November." . . . From Chicago, **Ed S. Pierson**, SM '60, ScD '64, writes: "My son, Alan, started as a freshman at MIT. I completed 10 years as head of the Department of Engineering at Purdue University at Calumet. I have also been involved for two years in a 5-week summer program for students completing grades 7,8, and 9, with a focus on minorities. The objective is to show that careers in engineering and science are attractive, fun, and well paid. Funding has been received from DOE, and is coming from NSF." . . . **Sandor R. Schoichet**, SM '81, EE '81, sends news from San Rafael, Calif.: "After four years with Teknekron Communications Systems, Inc., I am helping to start up a new division of the parent corporation, Teknekron Pharmaceutical Systems (TPS). TPS will focus on systems integration and software products in support of the new-drug clinical development and regulatory approval process."

Leonard Kleinrock, SM '59, PhD '63, reports: "I have been chair of the UCLA Computer Science Department since June of 1991. I'm on a review panel for the National Education and Research Network, and am a founding member of CSTB (NRC) and a co-author of the 1992 CSTB report, 'Computing the Future.'" . . . From San Jose, Calif., **Brian F. Coleman**, SM '87, sends word: "I'm working as an electrical engineer for General Electric's Nuclear Energy Division. More specifically, we are developing a gamma sensor for monitoring airborne radiation for use at a nuclear site." . . . **Kemp Wills**, SM '91, is manufacturing manager of Johnson & Johnson Consumer Product's Baby Washcloth Division in Royston, Ga. . . . **Craig Lewis Keast**, SM '89, EE '90, PhD '92, is employed in the Submicrometer Technology Group at Lincoln Laboratory at MIT.

Issac Moses Horowitz, '48, professor emeritus in the Department of Electrical Engineering and Computer Science at the University of California at Davis, has been awarded the Rufus Oldenburger Medal of the American Society of Mechanical Engineers. The medal, established in 1968, is given for outstanding achievements in the field of automatic control and is named for a leader in that field.

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Horowitz was cited for "outstanding leadership and contributions in the design of feedback control systems having significant parametric and non-parametric uncertainty, for conceiving and developing the quantitative feedback theory design method, and for exemplary leadership in feedback control education." Horowitz is the author of more than 75 technical papers. His texbook, *Quantitative Feedback Control*, deals with linear control analysis and synthesis. It has gained worldwide acceptance and was translated and published in Russian. He is also a professor emeritus at the Weizman Institute of Science in Israel, where he holds an endowed chair in applied mathematics. . . . **Norman Sears**, SM '52, retired last July from his position as space programs director after a 41-year career at Draper Lab in Cambridge. Sears started work at the Lab in 1951 on aeronautics projects as an MIT graduate student. Since the early 1960s Sears has been involved with programs for NASA, including the Apollo missions, the Space Shuttle, the Space Station, and Lunar/Mars mission scenarios.



David Acker

David E. Acker, SM '65, has been elected a Fellow of the Society of Motion Picture and Television Engineers (SMPTE). Awards are conferred on those who have attained an outstanding rank among engineers or executives in the motion-picture, television, or related industries through their proficiency and contributions. A pioneer in many developments in his field, Acker has been president of FOR.A Corp. of America for the past 10 years. Prior to that he was a founder of Microtime, Inc., and served until 1980 as its president and the leader of its technical team. Acker played a key role in early studies leading to two SMPTE standards. His work helped make possible the use of video cassette recorders in electronic newsgathering for networks and television stations. He is the author of numerous papers on electronic imaging, time base correction, component processing, and color correction, which have been presented at national and international conferences. . . . **Ronald R. Parker**, SM '63, ScD '67, director of the Plasma Fusion Center (PFC) since 1988, has been on leave from MIT for the '92–'93 academic year serving as deputy director of the International Thermonuclear Experiemental Reactor (ITER) project and head of its design center, located near Munich. Appointed acting PFC director is **Dieter J. Sigmar**, deputy director of the PFC since May 1991.

Edward J. Hronik, SM '66, of Littleton, Mass., died on August 26, 1992. Hronik was a computer specialist for Digital Equipment Corp. . . . The Association of Alumni and Alumnae has been notified that **David N. Truscott**, ScD '35, of Ely Cambs, England, died on April 11, 1992. No further information was provided.

VI-A INTERNSHIP PROGRAM

Judging from the inquiries received from Course VI sophomores, as this is being written in November '92, interest in VI-A Internship Program continues high. More concrete statistics will be available when the annual selection process begins in March. It is anticipated that VI-A will be allowed to grow by 10% in connection with the start of the Department's new five-year Masters in Engineering (MN) program.

Since 1982, the Department has had an endowed chair honoring 1894 graduate **Henry Ellis Warren**. The first, and current, holder is Professor **Louis D. Braida**, SM '65, PhD '69. My interest in Mr. Warren was sparked when I learned he invented the synchronous self-starting electric motor that made electric timepieces practical (most of you know of my interest in clocks and watches). Often, in the past, I've driven by the Warren Clock Co. plant in Ashland, Mass., with the "Telechron" sign on its wall. I have several electric clocks at home marked "Telechron Mvt." or "Telechron Motored" on the dial and they're still silently keeping excellent time.

By way of historical interest, I arranged to visit the Warren Telechron Co. prior to the closing of its doors the end of October 1992 in hopes of obtaining some material of interest for our MIT Museum. Mr. Warren's other major achievement was a method to allow the power companies to maintain their generators at a precise 60-cycle frequency (early generators were off by as much as 10–15 minutes per day until 1916). Obviously Warren's electric clocks wouldn't be much use if this regulation couldn't be done! More on this early EE history as this saga develops.

The latest in Departmental faculty honors: Professor Emeritus **William F. Schreiber** was given the "1992 Journal Award" by the Society of Motion Picture and Television Engineers for the most outstanding paper originally published in the society's journal during the previous year. It was entitled "Considerations in the Design of HDTV Systems for Terrestrial Broadcasting."... Two of seven National Science Foundation Young Investigator Awards given to MIT people were won by EECS faculty. **Srinivas Devadas** and **Gregory M. Papadopoulos**, SM '83, PhD '88, (this award was previously known as the Presidential Young Investigator Award).

In glancing through the American Society for Engineering Education's (ASEE) publication *Prism* for November 1992, I came across a quote from **Denice D. Denton**, '82, SM '82, EE '83, PhD '87, in an article entitled "Life Before Tenure." She said, "Junior faculty are almost a lost cause at this point in terms of being mentored; there are notable exceptions to the rule, but not enough." Denice is a tenured associate professor at the University of Wisconsin at Madison.

The IEEE's Boston Section October meeting of the Communications Society was addressed by **Whay C. Lee**, '83 (XIV), '83, SM '83, EE '86, PhD '89. His talk was entitled "Quality of Service Matching in Integrated Cell Relay Networks." Whay is with the networking research group at Motorola Codex in Canton, Mass.

Contacts with other VI-A's since last writing have included: **Joseph R. Babiec**, '90, back from two years in England as a Marshall Scholar and now working in Cambridge, Mass., for Monitor Co., joined me for lunch and later attended Tau Beta Pi's Fall Career Fair as Monitor's representative (a past president of Massachusetts Beta Chapter). . . . **Arthur G. Foyt**, '59, SM '60, ScD '65, manager of electronics research at United Technologies Corp., in East Hartford, Conn., was on campus exploring with several MIT staff about a closer affiliation with UTC. . . . **Joshua L. Koslov**, '79, SM '80, senior researcher in the R&D Division at Hitachi America, Ltd., in Princeton, N.J., was here attending an RLE sponsored "Workshop on High-Data-Rate Digital Broadcasting."... **Alexander Kusko**, SM '44, ScD '51, director of Kusko Electrical Division at Failure Analysis Associate in Westborough, Mass., wrote to tell me (after reading about **Anthony F. Gabrielle**, '49, SM '50, SM '61 (XV), in one of my previous columns) that he instructed (by correspondence) the first two VI-A students to go with American Electric Power Co. (one of whom was Tony Gabrielle) when Kusko was a member of the Department faculty. . . . **Michael J. Marcus**, '68, ScD '72, with the Federal Communications Commission in Washington, D.C., was also here for RLE's above mentioned workshop.—John Tucker, director emeritus, VI-A Internship Program, MIT, Room 38-473, Cambridge, MA 02139.

VII BIOLOGY

Elizabeth M. Kelly, '42, writes: "I retired from the Biology Department at Shea High School in Pawtucket, R.I."

Dorothea H. Hagan, '33, of Scottsdale, Ariz., died on September 9, 1992. Hagan had been employed in the food service industry, having worked as a dietitian for Crothy Brothers during WWII at various locations. She later taught at Proctor (Vt.) High School, and Trinity College in Burlington, Vt. She has served as chief dietitian at Cambridge City Hosptial, Brockton (Mass.) Hospital, and at the V.A. Medical Center in Manchester, N.H. Hagan was a member of the Phi Epsilon Omercron of Regis College, and had been a member of the American Dietetic Association.

VIII PHYSICS

From Middletown, R.I., **Stanley L. Ehrlich**, '48, writes: "As a consultant in acoustics, I am the new VP-elect of the Acoustical Society of America. I succeed Jiri Tichy of the Pennsylvania State University. I earned a BS in engineering and an MS in physics from Brown University in 1944 and 1945. I then attended MIT from 1945–48, where I was a teaching fellow in physics. From 1948–53 I was a physicist at the U.S. Navy Underwater Sound Laboratory in New London, Conn. I then joined Raytheon Co., where I worked in the Submarine Signal Division for 38 years before retiring in 1991."... **Allen Rubenstein**, PhD '67, reports: "I am a partner in a patent law firm in New York City. Since 1984, I've been specializing in litigating patent claims. My son Daniel, '92 (XVIII), just graduated from MIT, and my son Sam just started high school at Bronx Science."... **Hans Mark**, PhD '54, sends word: "I stepped down as chancellor of the University of Texas System after an eight-year tenure. I am now professor of aerospace engineering and engineering mechanics at the University of Texas at Austin."... **Bob D. Kaplan**, SM '86, reports from Belmont, Mass.: "I'm currently enrolled in the Master's Program at MIT's Sloan School, class of '94. I'm particularly interested to learn about the management of technological innovation."... **Max T. Weiss**, SM '47 (VI), PhD '51, in Los Angeles writes: "In December of last year I was appointed VP and general manager of the Electronics Systems Division of Northrop Corp. I have also been selected by IEEE to receive the Fredrik Philips Award for contributions to the management of R&D."

The University of California Press has recently published *The Meson Factories*, by Torleif Ericson, Vernon Hughes, and **Darragh Nagle**, PhD '47....



George Phillies

George D.J. Phillies, '68 (VII), '69, SM '71, ScD '73, professor of physics at Worcester Polytechnic Institute, has been given the Trustees' Award for Outstanding Research and Creative Scholarship. Phillies is recognized internationally as one of the leading authorities on the dynamics of polymer diffusion. His citation noted that he "has brought a new vision to the field of polymer dynamics and has been most effective in identifying the significant and experimentally verifiable features in macro-molecular diffusion." At WPI since 1985, he was a research associate at MIT, a research chemist at the University of California at Los Angeles, and an assistant professor of chemistry at the University of Michigan.... **Michael Marx**, PhD '74, a professor of physics at State University of New York at Stony Brook (USB), is part of a team working with Mohammad Mohammadi, also a USB physicist, who has been awarded a one-year, $100,000 grant by the Texas National Research Laboratory Commission. Mohammadi's group will study the properties of muon tracking devices for the SSC's GEM (Gammas, Electrons, Muons) detector. The GEM detector will record the speeds, directions, and types of all subatomic particles resulting from high-energy proton collisions at the underground SSC facility. Marx is working on the GEM project as deputy head of its muon systems group

Albert Blackwell, '62, professor of religion at Furman University, has just published a translation of Friedrich Schleiermacher's treatise "On Freedom." The book, which includes a 50-page introduction by Blackwell, is published by Edwin Mellen Press in Lewiston, N.Y. Schleiermacher was a prominent German theologian and philosopher who died in 1934. Blackwell, who has been a member of the religion faculty since 1971, is the Reuben B. Pitts Professor of Religion at Furman. He is also the author of *Schleiermacher's Early Philosophy of Life*, as well as the translation from the German of Hannsdieter Wohlfarth's *Johann Sebastian Bach*. Blackwell is the founding chair of the Piedmont Peace Resource Center.... NASA has selected **Claude R. Canizares**, director of the Center for Space Research and head of the Astrophysics Division of the Department of Physics, as the new chair of NASA's Space Science and Applications Advisory Committee. The committee, a standing committee of the NASA Advisory Council, consults with and advises NASA on its plans, priorities, objectives, and strategies to accomplish its multifaceted space-science programs. Canizares will also serve on the Advisory Council, which advises the administrator of NASA.... **Leonid Levitov**, and **Lisa J. Randall**, assistant professors of physics at MIT, are among 90 young scientists who have received fellowhips of $30,000 each from the Alfred P. Sloan Foundation.

Course VIII Professor **Robert P. Redwine**, a leader in medium energy nuclear physics research, has been named director of the Laboratory for Nuclear Science (LNS), where MIT's activities in experimental and theoretical nuclear and high-energy physics are carried out. Redwine succeeds Professor **Arthur K. Kerman**, PhD '53, who last June completed a term of nine years as LNS director. Redwine, who held positions at the University of Berne in Switzerland and at the Los Alamos National Lab, has been a member of the MIT faculty since 1979. He has been involved in a variety of important experiments in intermediate energy physics, spanning weak, electromagnetic, and strong interaction physics. Early in his career, he was involved in an extensive program of weak interaction studies. This resulted in a number of fundamental limits on processes beyond the Standard Model (muon-electron conversion, neutrino oscillations, and lepton number conservation). More recently he has concentrated on the interaction of pions and photos with nuclei. These studies have focused on the interplay between the internal dynamics of nucleons (protons and neutrons) and the surrounding nuclear medium.

The Association of Alumni and Alumnae has been notified of the following deaths: **Ormond Barstow**, ScD '38, of Midland, Mich., on July 25, 1992, and **Norman Rudnick**, SM '52, of Philadelphia, on August 9, 1992. No further information was provided.

IX BRAIN AND COGNITIVE SCIENCES

Mary Brown Parlee, PhD '69, has been named the Tallman Visiting Professor in Women's Studies at Bowdoin College in Brunswick, Maine, for the 1992–93 academic year. Parlee is a professor of psychology in the developmental psychology subprogram of the graduate school and university center of the City University of New York, and is a former director of the Center for the Study of Women and Society at the same university. She has also taught at Barnard College, Columbia University, and Wellesley College. Parlee has been a research fellow in psychology at Harvard Medical School, a research associate at the Social Problems Research Institute of the University of South Carolina, and a visiting research scholar at the Radcliffe (now Bunting) Institute at Radcliffe College, Harvard University. She is a former associate editor at *Psychology Today*.

Professor **Edward H. Adelson** of the Media Lab and Course IX has shared the prestigious 1992 Rank Prize for Opto-electronics. The award, presented at the Royal College of Surgeons in London, recognizes the work of Adelson and colleagues in investigating how the brain processes visual information and their elucidation of the mechanisms of motion perception. The prize was established by the late Lord Rank, a leading figure in the British film industry. Sharing the award were Professors J.A. Movshon of New York University, W.T. Newsome of Stanford University Medical School, and S. Zeki of the University College of London.

X CHEMICAL ENGINEERING

Robert Cotton, SM '40, writes: "I have been fully retired for two years and am enjoying Marco Island, Fla., in spite of the recent hurricane. Our damage was slight compared to the Homestead area. Plenty to keep me busy in church, local politics, fishing, and glass fusing—a growing new art form."... **Warren E. Stewart**, ScD '51, a professor of chemical engineering at the University of Wisconsin at Madison, was elected to the NAE in 1992.... Word from **Arunava Dutta**, ScD '85: "I am employed at the central R&D laboratory of GTE Electrical Products Group in Danvers, Mass. I was recently promoted from engineering specialist to manager of coatings technology. I've been issued three U.S. Patents. and five more are in the process of being issued. I'm active in AIChE and had five consecutive presentations at annual meetings."... From San Bruno, Calif., **Matt Croughan**, PhD '88, writes that he and Kathy are the recent parents of J.P., their son who was born in December, 1991.... **Richard D. Packard**, SM '51, reports: "I'm a semi-retired consultant at 64 1/2. I'm enjoying winters in Venice, Fla. Life is good!"... **Steven Cohen**, SM '68, sends word from Medford, N.J.: "I retired from Union Carbide in September 1992. I joined Agri-Diagnostics in Moorestown, N.J., that same month as director of the Environmental Products Group. Agri-Diagnostics is a partnership of DNA Plant Tech (NYSQ-DNAP) and Union Carbide (NYSE-UK)."

From Arlington, Va., we hear from **David L. Wagger**, PhD '92: "Even before getting a PhD, I began a AAAS Science, Engineering, & Diplomacy Fellowship to work in the U.S. Agency for International Development (AID) in its Office of Energy and Infrastructure. The work involves electricity production—conventional, wind, solar, renewable, and energy efficiency—in developing countries, and often requires travel overseas and collaboration with international organizations such as the World Bank. As of September 1, 1992, I entered my second (and last) year of the AAAS SED Fellowship Program."... **W.A. Holve**, SM '55, reports from England: "Well over 65 now and semi-retired, but still providing process design consulting services for gas plants and refineries in Holland, Bangladesh, India, etc. Also observing with interest from a distance the start-up of the South African natural gas to gasoline/diesel plant in Mossel Bay. Still recall with pleasure being engineering manager for a period on this mega-project with daily contacts with the major contractors, Fluor, Davy, Lurgi, etc. Will also enjoy our annual January holiday to our South African time-share unit. It's a beautiful country in spite of the political problems."

Manfred Gans, SM '51, writes from Leonia, N.J.: "As reported previously, in 1985 I 'retired' from Scientific Design Co., which I had joined upon graduating from MIT. We then set up our own company, TEDA, and now I am busier than ever and work is more interesting than ever. Initially, the United Nations Development Program, for which I act as a consultant for the 'Chemical and Refinery Sector,' kept me busy, but lately I had to cut down on that activity since I am overloaded with work for U.S. industry and private investors. I wrote the U.N. position paper on the Chemical and

Refinery Industy for the Rio Environmental Conference. The paper essentially was not accepted. In my opinion, it did not fit into the political views of the organizers. I don't agree with President Bush very often, but I support his publicly stated view that that conference was 'loaded.' My wife, who was well known to many of my classmates, died of cancer almost two years ago. Without continued professional activity, that loss would be still harder to bear."... **Peter W. Williams**, SM '57, sends word from Potomac, Md.: "My position at the U.S. Department of Energy as director of the High-Temperature Gas-Cooled Reactor Division includes sponsorship of a project being carried out by MIT Professor Larry Lidsky, PhD '62 (XXII), and his students of the Nuclear Engineering Department. This project is furthering a gas-turbine version of the helium-cooled, graphite-moderated, nuclear power reactor concept. Larry and I believe this project is the 'cutting edge' of nuclear power technology as it combines exceptional safety advantages with the magnificient accomplishments of the U.S. aero-space industry."

Behzad Jazayeri, SM '77, writes: "I moved to Irvine, Calif., in 1988, and I'm now working with Fluor Daniel, Inc., as a principal engineer. My field of specialty is fluid bed systems."... **Stuart L. Cooper**, '63, the Paul A. Elfers Professor of Chemical Engineering at the University of Wisconsin, has been named dean of the University of Delaware's College of Engineering. Cooper's appointment was effective January 1. The College of Engineering has 74 faculty members, and its enrollment for fall totaled 381 graduate students and 977 undergraduates. Cooper joined the faculty in 1967 as an assistant proessor. He was named an associate professor in 1971, full professor in 1974, and the Paul A. Elfers Professor in 1989. Cooper's research interests include polymer science and engineering, structure-property relations of polyurethanes, ionomers and block polymers, mechanical and dielectric spectroscopy, X-ray scattering, EXAFS analysis of ion-containing polymers, polyurethane biomaterials, and blood-material interactions.... **Graham A. Woerner**, SM '76, has been named quality control manager at DeWal Industries, Inc. He joined the Saunderstown, R.I., producer of fluoropolymer tapes and films last April as senior process and product engineer, responsibilities he retains in his new post. He came to DeWal from the Rogers Corp. where he worked for 13 years, most recently as a senior product development engineer. Woerner holds a patent for Isocore coax cable used in microwave telecommunications applications. For the American Society for Testing and Materials, he wrote *Specifications for PTFE Dispersion* which is pending adoption as a new specification by the International Standard Organization. He has done research in the pyrolysis of waste to fuel.

Alexis T. Bell, '46, ScD '67, a professor of chemical engineering at the University of California at Berkeley, has been named recipient of the R.H. Wilhelm Award in Chemical Reaction Engineering given by the American Institute of Chemical Engineers (AIChE). In honoring Bell, the institute's governing council cited his expertise as a teacher of kinetics, reaction engineering, and catalysis, and as a researcher specializing in heterogeneous catalysis. From 1979–81, Bell served as assistant dean of the College of Chemistry at the University of California at Berkeley, and for 10 years, beginning in 1981, he served as chair of the school's Department of Chemical Engineering. He joined Berkeley's faculty in 1967. Bell serves as principal investigator at the Materials & Molecular Research Division of the Lawrence Berkeley Laboratory in Berkeley. He is a consultant to W.R. Grace and Co., Eastman Kodak Co., and BIOSYM Technologies.... **Paula T. Hammond**, '84, a graduate student in Course X who works in the polymer physics group run by Professor Michael F. Rubner, PhD '86 (III), has been selected to hold a Ford Foundation doctoral dissertation fellowship for 1992–93. The fellowships are administered by the National Research Council to fund doctoral studies by minority students.

John Z. Raymond, SM '62, of Philadelphia, died on September 18, 1992. Raymond maintained a medical practice in New Jersey and was an assistant professor at the University of Pennsylvania.... The Association of Alumni and Alumnae has been notified that **Clarence B. Hanford**, SM '53, of Aurora, Ore., died on July 22, 1992. No further information was provided.

X-A PRACTICE SCHOOL

More than 50 alumni/ae participated in the Practice School's "day in the sun" last October—the 13th annual "Information Conference" at which SCEP celebrates its role in the Department's teaching and research, and when host companies first meet students who may later come to the Stations as their employees.

It was an upbeat meeting: chemical engineering enrollments are growing rapidly, from 55 undergraduates in 1991–92 to 75 this academic year to an estimated 95 in 1993–94. Many of these will apply for the five-year SB/SM program that includes the Practice School.

In addition, most of MIT's Course X doctoral candidates elect to attend the Practice School, and their numbers are growing too. The SCEP experience is important for them, since 90 percent ultimately take jobs in industry. Indeed, **Robert A. Brown**, head of the Department, said with pride that the experience of the Practice School means that its graduates are "the best chemical engineering product in the nation."

The only question at the meeting was whether the sharpness of the doctoral students' SCEP experience is dulled by the long years of thesis research and writing before they take their industrial jobs. Both Professor Brown and Professor **Alan Hatton**, director of the Practice School, minimized this problem and noted that the Department was seeking to reduce the time required for doctorates.

Eleven sponsoring companies now provide fellowships for SCEP students while they are in Cambridge for graduate work before going to the stations; their grants represent 11 percent of the Practice School's total annual funding. The following, in addition to Dow and Merck where SCEP stations are located—were represented at the Information Conference by alumni: Air Products & Chemicals, Inc. (**Siegfried T. Mayr**, SM '67, ScD '70, who was director of the Bound Brook Station in 1970–71 and now is director of research and engineering systems at Air Products); Badger Engineers, Inc. (**Leo W. Bonnell**, '77, SM '78, senior process engineer); E.I. du Pont de Nemours Co., Inc. (**William Raiford**, SM '85, PhD '89, research engineer); Exxon Corp. (**Jay E. Sobel**, '61, SM '63, PhD '68, general engineering staff, Exxon Research & Engineering Co.); Hercules, Inc. (**Peter Melnik**, '52, research supervisor); Lever Brothers Co. (**Charles Irwin**, '80, SM '81, manager of new process technology); Mobil Oil Corp. (**Robert Hanlon**, SM '83, PhD '85, senior staff engineer); and Rohm and Haas Co. (**Kirk Limbach**, PhD '89, process engineer in the Corporate Research Laboratories).

Three other companies that are major sponsors of chemical engineering fellowships were also represented by alumni at the all-day program: Amoco, Inc. (**David S. Sabo**, '61, SM '63, supervisor of the Computer-Aided Process Engineering Group, Amoco Research Center); Koch Industries (**Charles W. Selvidge**, '63, ScD '66, director of chemical R&D); and Kelco Division of Merck & Co. (**Paul F. Mosher**, '55, president).

At the meeting Judith Bland, special assistant to the VP for Engineering and Technology at Merck headquarters in Rahway, N.J., said the company was "very satisfied" after the first 15 months of the West Point Station's operations at Merck's Manufacturing Division. She was accompanied in Cambridge by **Michael J. Glodek**, '83, SM '84, the Merck–SCEP liaison officer at West Point.

Keith Bailey, director since 1991 of the West Point Station, left the station at end of 1992 to join the Merck staff; he has been succeeded by **Thomas Meadowcroft**, PhD '92; **Edward Browne**, SM '91, interrupted his PhD studies at MIT to be assistant director starting last fall, succeeding **Ulrich Holeschovsky**, SM '90, who is back at MIT to finish his doctorate.

Professor Hatton told the SCEP's annual business meeting that he expected a report early in 1992 from an ad hoc committee to review the academic preparation of Practice School students. Station and company staffs have suggested that students need better preparation in process systems engineering and statistical experimental design and data analysis, and Hatton expects the committee to recommend changes in the program of core courses for SCEP students.

The one-day Information Conference ended with a festive Faculty Club dinner for all participants, including many recent SB and Practice School graduates. In addition to all those noted in the previous paragraphs, alumni/ae at the dinner included the following (all those not otherwise identified are now graduate students at MIT working toward doctorates): **Paschalis Alexandridis**, SM '90, **Antonia Banks**, SM '92, now working at Ionics, Inc.; **Jennifer Chan**, '92; **Gordon Craig**, SM '89; **Alexander Diaz**, SM '91, **Vivek Dodd**, SM '92, **Trinidad Flores**, '92; **Aleksander Franz**, '90, SM '91, who continues as assistant director at the Midland Station; **Ranganathan Godavarti**, SM '92; **Hongbin Ni**, '92; **Ulrich Holeschovsky**, SM '92; **Gilbert Huppert**, SM '89; **Lloyd Johnston**, SM '92; **Roy Kamimura**, SM '92; **David Lee**, SM '79; **Joanne Liu**, SM '88, PhD '92; **Philip Marrone**, SM '92; **Jerome Meier**, '89, SM '90, now a student at Harvard Business School; **Joy Mendoza**, SM '89; **Vivek Mohindra**, SM '90; **David Oda**, SM '92; **Michael Pomianek**, SM '90; **Gerald Prioleau**, SM '90; **Carlos Rojas-Guzman**, SM '91; **Bruce Scruggs**, SM '88; **Gordon Smith**, SM '90; **Michael Szady**, SM '92; **Jonathan Tan**, SM '92; **Ganesh Venkataraman**, SM '89; **Friedrich von Gottberg**, SM '92; **Paul Webley**, SM '90, PhD '90, former director of the Midland Station who is now at Air Products and Chemicals, Inc.; **Colin Wolden**, SM '92; **Gabriel Worley**, SM '88; and **Xinjin Zhao**, SM '90.

Special dinner guests included Professor Emeritus **Hoyt Hottel**, SM '24, who only two days before had been honored by establishment of the Hottel Professorship, announced at a dinner for 200 at the Museum of Science; Professor **Gregory J. McRae**, who spoke following dinner on technical and political issues in air quality management; **William C. Rousseau**, SM '36, visiting senior lecturer emeritus in the Department; **David S. Saxon**, '41, PhD '44, chair emeritus of the MIT Corporation; and Professor **Jefferson Tester**, PhD '71, director of the MIT Energy Laboratory who was SCEP director form 1980–89.

SCEP awards for 1991–92: The Rosemary Wojtowicz (SM '82) Fellowship for personal qualities of kindness and concern for others to **Ridwan Rusli**; the Jefferson Tester Prize for enthusiasm and leadership to **Friedrich von Gottberg**, SM '92, and the J. Edward Vivian (SM '39) Prize for outstanding project work to **Colin Wolden**, SM '92. And finally a special citation, the "Mother Award," to Carol A. Phillips, administrative secretary of SCEP, for "taking the art of mothering to new heights through her kindness, compassion, assistance, and ready shoulder for Practice School students to cry on."

While all this was going on during October, we heard from three other X-A alumni: **Lawrence R. (Larry) Sewell**, SM '70, CHE '72, wrote from Dallas, where he now manages the ethylene and propylene business of Oxychem, Inc.; he was formerly with Occidental Chemical Co., in Niagara Falls. The move to Dallas is a big change for the family, says Sewell, but "Carol is adapting to Texas," he writes, "and the children are doing well in 8th and 5th grades."... **Marc Machbitz**, SM '78, writes from Foster City, Calif., that he and Lori are rejoicing in the arrival of their second child, Aaron Michael, born last June 15.

The *San Francisco Chronicle* reported on September 4 the retirement of **Paul R. Larson**, SM '54, as VP for supply and distribution of Chevron USA, Inc.... **Robert S. Hand**, SM '38, who retired in the early 1980s from the Du Pont Co., died on July 25, of cancer, for which he was first treated on April 2. Burial was in Arlington Memorial Cemetery with

full military honors.—John Mattill, *Technology Review*, MIT, Room W59-200, Cambridge, MA 02139.

XI URBAN STUDIES AND PLANNING

Susanne Rasmussen-Costello, MCP '89, writes: "I recently started my new job as program manager at the Conservation Services Group (CSG). CSG is a Boston-based company that implements energy conservation programs for gas and electric utilities. I live in Boston's Little Italy, the North End. Speaking of Italy, my husband, Tim, and I visited Fabio Dumantet, who attended MIT (Course IV) 1985–86, in Napelis, Italy in Febrary of 1992. I encourage all of you Course IV and XI graduates to send notes on yourself to *Technology Review*. I, for one, skip straight to 'Course News' everytime the magazine arrives in the mail!" . . . From Madrid, **J.L. del Valle**, '85, reports: "After the merger of Banco Hispano Americano into Banco Central, and as director general adjunto of the merged bank, Banco Central Hispano, the largest in Spain, I was made head of the Capital Markets Area of the bank."...



Irene Jenkins

Irene D. Jenkins, SM '89, has been appointed director of development at the Vermont Housing Finance Agency in Montpelier, Vt. Jenkins has worked in the fields of community development and affordable housing for over 15 years. Most recently she was housing development coordinator for the Rhode Island Housing and Mortgage Finance Corp. Previously, she held several posts with the U.S. Department of Housing and Urban Development. In addition to her background in development and program administration, Jenkins was a Fulbright Scholar. . . . Word from **Aurelio Menendez**, PhD '90: "This past summer was rather busy for me. I was promoted and changed to a new division at the World Bank. I moved to a new, bigger apartment in the Northwest of Washington, D.C., near the National Cathedral. And, most importantly, I got married! The wedding was celebrated in Santa Cruz, Bolivia, the country my wife, Cira, comes from. From there we went to Paris, Geneva, Yvoire, Montreux, Interlaken (Switzerland), and Asturias, Spain, the region I come from."...

Caroline Clarke Guarnizo, PhD '91, reports from Washington, D.C.: "I am now the director of the National Academy of Sciences/National Research Council's Board on Natural Disasters. The board provides a focal point for planning, coordination, and representation of the NRC's disaster reduction activities and advises the federal government in this criticial area."... **Alexander Jaegerman**, MCP '81, writes from Cambridge: "I am presently on leave from my position as chief planner in Portland, Maine, as a Loeb Fellow in Advanced Environmental Studies at Harvard Graduate School of Design. During this year I will be exploring concepts in urban design, community building, and computer-graphic models." . . From Brookline, Mass., **Alan Sager**, PhD '79, reports: "I have just begun my tenth year at Boston University School of Public Health, where I'm studying causes of high health costs and methods of remedying them while covering all citizens."... **Joshua S. Haimson**, MCP '83, sends word from Brooklyn, N.Y.: "I completed a PhD in economics at Yale University in September 1992. In October I was made a research associate at Manpower Demonstration Research Corp."... **Thomas J. Nally**, MCP '77, is living in Brookline, Mass. . . . **John Bullard**, MCP '74, writes: "Having served six years as the mayor of New Bedford, Mass., I now work at the New Bedford Seafood Co-op. I work with commercial fishermen to develop fishery management plans that protect both the resource and the traditional fishery."... **Greg T. Ricks**, MCP '72, [PHOTO] has been named VP for education and training at City Year, the acclaimed "Urban Peace Corps" program based in Boston. Ricks, formerly a multicultural specialist at Stanford University, joined the four-year-old program in August 1992. City Year, which has attracted national attention and drawn in millions of dollars in private donations and foundation grants, offers college scholarships to youths in exchange for community service. City Year employs 75 staffers who direct the activities of 225 corps members. Ricks is an experienced trainer, facilitator, and keynote speaker. He had made presentations to over 100 colleges and high schools across the country and has worked with hundreds of students, faculty, and community agencies. The main themes of Ricks' work include public and community service, social change, multiculturalism, community service as common ground for interactive multicultural understanding, community building, and the challenges of a college education. . . . **Ross E. McKinney**, SM '49, ScD '51, the N.T. Veatch Distinguished Professor of Civil Engineering at the University of Kansas, has received the 1992 Chancellors Club Career Teaching Award. The club, formed in 1977 by the KU Endowment Association, provides a substantial base of unrestricted resources for the benefit of KU. Each year the club honors a senior faculty member who has taught at KU for at least 15 years who exemplifies the university's commitment to outstanding teaching. "After 32 years of service to the university and a long list of awards and achievements, McKinney's focus remains on the students," states a KU news release. Before joining the KU faculty, McKinney was an associate professor of engineering at MIT.



Michael O. Jackson (left) with Alexander Farrelly, governor of the U.S. Virgin Islands.

Michael Onaje Jackson, MAR '82 (IV), MCP '82,(left), writes: "As director of the Virgin Islands Renewable Energy Institute, I joined Alexander Farrelly, Governor of the U.S. Virgin Islands, in officially breaking ground on one of the Nation's first renewable energy districts located in the historic town of Frederiksted, St. Croix. When complete, the district will be a model energy-efficient community, featuring widespread use of solar, wind, and other renewable energy technologies. Currently, over 99 percent of the district's energy comes from polluting, imported petroleum. The renewable energy district project is just one of a number of energy projects I am developing at this new applied research institute dedicated to promoting the widespread use of renewable energy technologies throughout the Caribbean region. I originally moved to the Virgin Islands in 1989 with my wife, Barbara Lee Jackson, and two children, to provide special technical assistance to the Territory's Energy Office and Department of Planning and Natural Resources. Prior to this move, I was an associate with a leading architectural engineering firm in the Empire State Building in New York City."

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Catherine M. Koza, MCP '90, of Littleton, Colo., died on July 18, 1992, in Pakistan. Koza was a program officer with UNOCA, a United Nations program that coordinated humanitarian programs in Afghanistan. She headed a work-for-food program in Kabul with the World Food Program.

XII EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

Wade D. Jensen, SM '78, has become an associate with the law firm of Anderson, Laffey, Eckert & Ferdon, of Norwich, Conn. He will specialize in tax and estate planning. . . . **Joseph Salah**, PhD '72, director of MIT's Haystack Observatory, was one of the 25 scientists behind the three-week Young Scholars summer program for Boston-area middle-school kids. 30 seventh-through-ninth graders were picked from 250 applicants. Haystack scientists try to target kids before their youthful curiosity withers. "We felt that's the age when the spark of interest can be lit to last through high school," Salah said. This past summer was the third year the program had been run.

XIII OCEAN ENGINEERING

Captain **Henry P. Rumble**, SM '38, writes: "Since receiving a master's degree in naval construction, I served in the Navy in several capacities in design, construction, and repair of naval ships of all types, until my retirement as a captain in 1961. This was followed by nine years as a research engineer with the Rand Corp. in Santa Monica, Calif. From 1970 I was a development engineer with the Marine Physical Laboratory of the Scripps Institution of Oceanography in San Diego, until April 1992, when I retired completely and moved to the Ventura Towne House, a retirement community in Ventura, Calif. This is not even a thumbnail sketch of a 54-year career in my chosen profession."... **John M. Chiffer**, SM '83, was recently married to Joan Morrison. They are currently residing on the North Shore of Massachusetts and are employed by Draper Laboratory. . . . **James M. Averback**, SM '80, reports: "I am director of the Laboratory for Applied Computing at the Thomas Jefferson Medical College at the Thomas Jefferson University in Philadelphia, Pa. I work on applied computing in biomedical resfearch and structural biology."... Lieutenant Commander **Geoffrey L. Abbot**, SM '82, OCE '82, sends word: "I was recently selected for promotion to commander. I am currently assigned as chief of the Facilities Engineering Division (84 personnel) at the Coast Guard's 7th largest base, Cape May, N.J. I am serving on the Southern Cape May Region Water Advisory Commission attempting to overcome saltwater intrusion into Cape May's fresh water aquifers."

Rear Admiral **Walter H. Cantrell**, SM '65, NE '65, reports: "On September 30, 1992, I assumed command of the U.S. Navy's Space and Naval Warfare Systems Command."... Rear Admiral **E. Alvey Wright**, SM '39, (ret.) sends word from Kailua, Hawaii: "I'm working mostly in air, ocean, and land transportation; plus fission, solar, and fusion energy."... From Athens, Greece, **Dimitris Petrongonas**, SM '76, writes: "I am technical director and partner of ICP & Associates, Ltd. I successfully finalized the extended modification (about $20 million) of the 9000 GRT passenger ferry *Mytilene*, fully covering ship design, supervision, and project management. The 1974 vessel, which has been completely modernized for approx 1,700 passengers and 60 trailers or 270 private cars,connects Piraeus with Chios, Lesvos, and Limnos Islands in the Greek Aegean Sea. (Project duration July 1990–July 1992) I also recently reengineered the passenger-ferry *Sapfo* including all auxiliary machinery, pipings, controls, etc. Results, from weight trimming, reballasting, etc.: service speed increased from about 14.5 to 19 knots!, and cargo carrying capacity by +50%!"... **Michael F. Vetter**, SM '71, reports from Salem, N.H.: "I am presently manager of the Office of Technology Development at TASC in Reading, Mass. I'm working on bringing new information technologies into the company and into our services as a differentiator. My latest project is a secure dial-up network for customers in the Washington, D.C. area."

Word from **Steve Banerjee**, SM '85: "I am now an assistant VP at Bankers Trust Co. in New York where I am involved in technical trading activities in the foreign exchange markets. Previously I had worked for Goldman Sachs and the American Bureau of Shipping."... Commander **Leon H. Leutz**, NE '51, SM '56 (XXII), reports from Gladstone, Mich.: "I am most satisfactorily retired, with thanks to MIT for helping make retirement possible."... **Daniel Hunt**, SM '48, writes that he and Shirley have moved to Chestertown, Md. . . . Lieutenant Commander **Mark J. Olechowski**, SM '90, reports from Williamsburg, Va.: "I am working as a submarine new construction project officer. and we just delivered *Boise* (SSN 764) to the U.S. Navy. *Boise* is the 50th 688-CI Los Angeles submarine delivered to the Navy."... From Fairfax Station, Va., **Walter S. Szczypinski**, NE '66, sends word: "I retired from the Navy in November 1984. I am executive VP of Techmatics, Inc., an engineering services company in Arlington, Va., which I joined in 1984 in its second year (19 employees, $2M revenue). I helped lead growth to current 400 employees and just under $30M revenue and 3 years on *Inc.* 500 list of fastest growing companies in the U.S.A."... **Paul P. Daulerio, Jr.**, SM '70, has been named general manager for International Aviation-Fuel Sales at Texaco, Inc. Previously, he was assistant to the VP at Texaco. . . . Navy Lieutenant Commander **Mary Townsend-Manning**, NE '87, recently graduated from the Submarine Officer's Basic Course in the Navy. During the 12-week course at the Naval Submarine School in Groton, Conn., students are taught the theory, construction, and operation of nuclear powered submarines. In preparation for their first submarine assignment, students receive instruction on shipboard organization, damage control, submarine safety, and escape procedures.

Bruce Skinner, NE '65, has been appointed dean of the College of Engineering at the University of Bridgeport in Conn. Skinner's career has focused on education and administration in a variety of ocean engineering areas. During his Coast Guard career, he has been assistant engineering officer on two cutters, commanding officer of a LORAN navigation station in Alaska, and a naval architect at Coast Guard headquarters in Washington. Returning to the Coast Guard Academy, he taught a variety of ocean engineering subjects as well as physics and computer science. Skinner retired from the Coast Guard with the rank of captain in 1990 after 31 years of service. . . . Captain **John F. McGowan**, SM '76, OCE '76, has taken over as chief of the Merchant Vessel Personnel Division of the U.S. Coast Guard in Washington, D.C. For the past three years, McGowan was at the helm of the Coast Guard's Marine Safety Office in Portland, Maine. In his new position he is responsible for the licensing of all U.S. merchant marine officers and seamen. . . . The MIT Department of Ocean Engineering, in conjunction with the Graduate Alumni/ae Program, held a reunion for Course XIII alums on October 29, 1992, at the St. Moritz Hotel in New York City. Course XIII Department Head **Francis Ogilvie** introduced the evening's featured speaker, Rear Admiral **Malcolm MacKinnon**, SM '61, NE '61 (USN, ret.). Ogilvie also highlighted the upcoming Technology Day of which Ocean Engineering will be the main focus, "Riding the Wave of Innovation: MIT and the Ocean." The event was held in coordination with the Society of Naval Architects and Marine Engineers Annual Meeting that was taking place from October 28–31 in New York City. Approximately 50 alumni attended the event.

John R. Kane, SM '40, of Newport News, Va., died on November 20, 1991. Upon commencement of his career, Kane was employed as a draftsman by the Newport News Shipbuilding & Drydock Co., where he spent his entire professional career of 38 years, rising to the position of director of engineering by his retirement in 1974. He was promoted to the position of engineer of the Engineering Technical Department in 1951, was named assistant chief engineer of the Machinery Design Division in 1955, and in 1957 was promoted to chief engineer of that division. In 1966 he was appointed director of engineering of the shipyard, responsible for all hull and machinery technical design and management. Kane pioneered the first application of high-pressure, high-temperature steam systems for ship propulsion, which were installed in the passenger ship SS *United States*, and U.S. Navy aircraft carriers. He was a leader in the design, development, and testing of nuclear power plants for submarines and aircraft carriers, and was responsible for the machinery systems and state-of-the-art advancement of several classes of cargo vessels and tankers. He was a long-serving member of the Society of Naval Architects, having served as VP, a member of the executive committee, and as a member of the council during his 54 years with the society. Kane was instrumental in the establishment of the *Journal of Ship Research*, and won the 1978 Vice Admiral E. L. Cochrane Award for his paper "Speed of the S.S. *United States*.

The Association of Alumni and Alumnae has been notified of the following deaths: Captain **Wilfred M. Howerton**, NE '50, of Davis, Calif., on July 25, 1992, and Rear Admiral **Edward S. Carmick**, SM '40, of Saratoga, Calif., on September 23, 1992. No further information was provided.

XIV ECONOMICS

From Alexandria, Va., we receive word from **Paul N. Van de Water**, PhD '75: "In January 1991, I was appointed deputy assistant director of budget analysis at the Congressional Budget Office, with which I have been associated since 1981. **Rick Kasten**, PhD '75, was recently named deputy assistant director for tax analysis."... **Arthur G. Ashbrook, Jr.**, PhD '47, reports: "Semi-retired, I teach part-time at American University in Washington, D.C. , and work one day a week on the economic entries in CIA's annual *World Factbook*, for which I try to distinguish true facts from non-true facts."... **John Rust**, PhD '83, writes: "I was awarded the 1992 Ragnar Frisch Award for my 1987 article 'Optimal Replacement of GMC Bus Engines: An Empirical Model of Harold Zurcher' (*Econometric*, Vol. 55-5, pp. 999–1033). I am professor of economics at the University of Wisconsin in Madison."... **Marco Hanig**, PhD '87, reports from Winnetka, Ill.: "I am working in Chicago as VP for corporate strategy at the First National Bank of Chicago. My wife, Courtney, and I and our daughter, Mallory (3), would love to hear from classmates visiting the area."... **David McClain**, PhD '74, writes: "I was named acting dean of the College of Business Administration at the University of Hawaii in September, 1992. I joined the university in January, 1991, as the Henry A. Walker, Jr., Professor of Business Enterprise & Financial Economics."

William N. Talmers, PhD '54, of Flushing, N.Y., died on July 9, 1992. He spent 22 years as an investment advisor on Wall Street. For 11 years he was with the European-American Corp. and 11 years as principal of the William N. Talmers Co. in New York, N.Y. For the past 10 years, he had been associate professor of economics at Molloy College, where he had received the president's medal award in 1991. . . . The Association of Alumni and Alumnae has been notified that **Robert H. Legg**, SM '42, of Sun City West, Ariz., died on June 28, 1992, of pancreatic cancer. No further information was provided.

XV MANAGEMENT

From Brookline, Mass., **Sidney Kriger**, SM '89, wrote to us at the end of September: "Jill and I are expecting

our first child at the beginning of November. At the same time, we expect the fruits of Jill's efforts on the Clinton campaign to sweep him to victory. Of course, the new baby will be the much bigger thrill and have a more astounding impact on our lifestyle." Kriger is a product marketing manager at Xylogics, Inc., in Burlington, Mass. . . . **Steve Leichtman**, SM '86, reports: "I was recenftly promoted to principal at Mercer Management Consulting (formerly Temple, Barker and Sloane) where I specialize in organization planning and development. Gail, I, and our two sons, Nathan (4) and Devon (1), live in Lexington, Mass." . . . **Lunn Rosenman Garland**, SM '85, sends word from Chevy Chase, Md.: "I am still working in manufacturing at E-Systems, expecting my second child. Working four days a week has allowed me to balance work and family. I feel quite fortunate to have this balance and wish it were more the norm." . . . **Kemp Wills**, SM '91, is a manufacturing manager for Johnson & Johnson Consumer Products' Baby Washcloth Division in Royston, Ga. . . . Word from **Tom Darbonne**, SM '91: "I'm active in starting a Northern California MIT/Sloan Club. I have frequent gatherings with Bay Area alumni/ae. As part of first Wednesday, we had a BBQ and mountain bike trips. My dog is over 150 lbs. Bought a house in Menlo Park. *I still need more submissions for the Sloan SM91 Newsletter.*" . . . From Dearborn, Mich., **Henry E. Fradkin**, SM '71, writes: "I was recently promoted to director of product strategy and planning in the Worldwide Automotive Strategy division of the Ford Motor Co. The primary function of my office is to lead the development of a long-range global car, truck, engine, and transmission product plan for Ford and affected associates."

Arthur P. Alexander, SM '58, is holding strong as president of API, Inc., in Weston, Mass. . . . **Bill Glaser**, SM '57, writes: "I have substantially retired by selling my business to my employees. I divide the year between Naples, Fla., and Westport, Mass. My retirement activities include arbitration for both NASD and NYSE, real estate management, travel, and tennis." . . . From Los Angeles, where he is president of West L.A. Realty, **Giyora Doeh**, SM '58, reports: "In a difficult real estate market, what's a real estate broker to do? Set an example! I've moved from a very nice condo near UCLA, which I've managed to rent to students, into a small house that has been difficult to rent, in Mar Vista, lowering my housing cost and affording an opportunity to refinance for further savings." . . . **Beth Klingher**, SM '86, is president/consultant at Willow Solutions in New Haven, Conn. She writes: "I've recently had a baby girl—Hannah Rose—on May 18th. She's keeping me very busy! I'm still working in my own business—doing software development in Microsoft Windows and consulting. Enjoying both work and motherhood." . . . **Toby S. Mannheimer**, SM '77, sends word: "I have recently accepted a position with United Technologies-Carrier Corp. I am responsible for all operations in Latin America; we are based in Miami." . . . From Wayland, Mass., **Sarah Shoaf Cabot**, SM '85, writes: "We moved back to the Boston area in April 1992 so that my husband, Chip, could co-found a new biotechnology company, Ariad Pharmaceuticals, in Cambridge. I have transferred to Boston College Law School after taking a year off to play with our son, Charlie, born on June 15, 1992. I hope to catch up with old Sloan friends in the area soon."

Burt Nanus, SM '59, sends word from Santa Monica, where he is a professor of management at the nearby University of Southern California: "My latest book, *Visionary Leadership* (Jossey-Bass, 1992), has been selected as a Fortune Book Main Selection and a Book of the Month Club Alternate Selection." Commenting on the book, U.S. Senator Bob Graham is quoted as saying, "Ideas with vision have power and magic that carry those ideas beyond the people who create them. Burt Nanus shows us how to find such vision." . . . **Karen Epstein**, PhD '87, writes: "I'm living in Ann Arbor, Mich., with my husband, Al Franzblau, and our two daughters, Rachel (4), and Lauren (14 mos.)." . . . **Aaron Prince**, SM '91, who works at Bear, Stearns & Co. in international fixed income, reports: "Big news indeed—Louis is over 20 pounds and not yet 6 months old! Michele and I are on a weight-lifting program, just taking care of our boy. Also, Bear Stearns made us an offer we could not refuse, so now it's Manhattan, I am happy to report." . . . **Jeff Wickman**, SM '84, sends word: "I'm enjoying my fifth year consulting in logistics and customer service as a senior consultant in Arthur D. Little's operations management practice in Cambridge. My son, Sam, is a joy at one year old." . . . **Avi A. Frydman**, SM '81, writes: "I've moved to a product management position in Digital Equipment Corp. My family has acclimated to Baltimore, Md., and I don't miss the snow." . . . From Wellesley, Mass., **Tom Ruddy**, SM '87, reports: "I have left Boston Consulting Group to join Fidelity Management & Research Co. as director of business planning and analysis."

David Gardner, SM '91, writes from Rockville, Md.: "Stephanie (my lovely new bride) and I are thoroughly enjoying Washington ,D.C. (and life in general). Work at the International Finance Corp./World Bank is interesting with a number of international projects. Are there any Sloanies out there in Thailand, Pakistan, or Senegal?" . . . **Selina Chow**, SM '81, is the manager of business planning at the Cambridge-based Open Software Foundation. She writes: "Daughter, Joanna, is 6 years old, and son, Jason, is 4." . . . An update from **Robert P. Lensch**, SM '83, in Switzerland: "1992 has been an eventful year: after three years of managing information systems development in Spain, Dow transferred me back to Switzerland where I now am involved in 'reengineering' several of the company's work processes. Between positions, Quyen and I spent 2 months sailing along the Spanish coast and Balearic Islands. We finally decided to tie the knot and got married on September 19. **Young Sohn**, SM '83, came over from Oregon to celebrate this event with us." . . . From N.Y., **John Lively**, SM '85, writes: "I'm working in Corning's Opto-Electronics Group (optical fiber). Heavily involved in policy analysis and forecasting related to future telecommunications services, recently the FCC's video dial tone decision, and the Cable Reregulation Bill in Congress. My daughter, Sarah, is 14 months old and, son John M., is 3. I'm also very active in Corning's employee education and workforce diversity programs." . . . We receive word from **Anthony Scolaro**, SM '87, who is a proposal consultant at Digital Equipment Corp. in Landover, Md.: "Loren is now in her terrible twos, walking, talking, and thrilling daddy. Anthony, Jr., is 9 months old and Yvonne and I are wondering what happened to our lives! And I thought Sloan was work!"

Dan Beardslee, SM '86, is VP for venture capital at Demery Seed Capital Fund in Franklin, Mich. He writes: "My wife, Sue, and I are happy to announce the birth of our daughter, Laura Rose, on April 8, 1992—our first child! I am one of a handful of practicing venture capitalists in Michigan." . . . We receive word from **Armins K. Rusis**, SM '91, who is an associate in investment banking at Morgan Stanley & Co.: "I was recently married (September 26, 1992) in La Jolla, Calif., to Julie Garrett. We are living in New York City." . . . **Satya N. Bagaria**, SM '67, is president of International Exports & Importants in West Haven, Conn. . . . **Robert C. Salipante**, SM '81, is senior VP and CFO at The NWNL Co. in Minneapolis. He is living in Minnetonka, Minn. . . . From Spartanburg, S.C., **Carl P. Lehner**, SM '80 sends an update: "**Sandra Schultz Lehner**, '73 (XVIII), SM '80, and I have our fourth child, Erica, born June 17, 1992. We now have a very full house! I am still very busy at work as president of Leigh Fibers, a textile by-products recycling company. As recycling is now in vogue, I have been giving speeches on our industry, hoping to encourage more recycling." . . . **Mark K. Rosenfeld**, SM '70, president of Jacobson Stores, Inc., in Jackson, Mich., was elected CEO at the May 1992 board meeting of his company. . . . **Marjan Ghahramani**, SM '92, reports: "Right now I'm working at A.T. Kearney, Inc., as a management consultant to financial services and living in New York." . . . **Juan Carlos Torres-Carretero**, SM '79, writes: "We have moved temporarily from Boston to Madrid, Spain, to continue doing venture capital deals for Advent International." . . . **Jorge F. Hidalgo**, SM '92, sends an update: "Home and most of my property destroyed during Hurricane Andrew on August 24, 1992, in Miami, Fla. I'm affiliated with United Technology-Carrier's Leadership Associate Program. I'm working on regional purchasing consolidation, Kaizen, statistical process control imple-

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mentation and performance metrics. I live close to Ft. Lauderdale and will take visitors."

Pierre J. de Weck, SM '76, reports: "After five years in New York in charge of Union Bank of Switzerland's North American operations, I returned to Zurich, Switzerland, with responsibilities for the bank's European operations. I would welcome news from Europe-bound classmates." ... **Glenn T. Migliozzi**, SM '86, writes: "I recently joined State Street Bank as a VP/portfolio manager in the Asset Management Area. I'm glad to return to the Boston area." ... From Rowley, Mass., **S. W. Bailey**, SM '87, sends word: "Our second child, Sarah Bailey Hardy, ws born in late April 1992. I continue to work as town accountant, while this summer we, as Willowdale Farm, grew organic produce for the local gourmet restaurant market." ... From New York City, an update from **David Levinthal**, SM '81: "Recently, the Museum of Modern Art in New York purchased four of my pieces for their photography collection. These photos were exhibited with William Wegman at the Museum Moderner Kunst (Museum of Modern Art) in Vienna." ... **Robert B. Hedges, Jr.**, SM '84, reports: "We moved back East to Connecticut in June. Our third child, a girl, was born in August. I'm currently pursuing a variety of interesting financial services research and investment projects awaiting the end of my non-compete period with my former employer. Really looking forward to joining First Manhattan Consulting Group as VP." ... **Mike Markovits**, SM '85, writes: "After two years in Cincinnati, I have transferred again—this time to GE's Plastics business, headquartered in Pittsfield, Mass. I have human resource responsibility for nine plants spread across North America. My wife, Joanne, continues to reside in Melrose, Mass., so I make it back to the Boston area most weekends." ... An update from **Carl Hamilton**, PhD '69, in Arcadia, Calif.: "I have been appointed managing director of financial strategies for the Prudential Insurance Co. For the past five years, I have been senior VP and director of research at First Interstate Bank, Ltd., in Los Angeles."

Alfonso J. Gallardo-Kuri, SM '71, is assistant VP at Merrill Lynch in El Paso, Tex. ... **Larry A. Green**, SM '78, sends news: "I have recently joined the Northern Trust Co. as VP for cash management marketing." ... An update from **Jose Vasconcelos Sousa**, SM '86: "Greetings to all Sloanies, especially to my class, from sunny Portugal. I have started a consultancy directed to investors interested in Portugal, an excellent point to enter the EEC. If you are considering this part of the world for business or pleasure, do not hesitate to get in touch. For our great joy, we had **Arnoldo C. Hax**, the Alfred P. Sloan Professor of Management, visiting last June. His talk was a great success, and his inteview with a monthly business magazine *Expansao*, was quoted by the press. The club looks forward to other visits." ... **Warren H. Hausman**, PhD '66, reports: "After serving as chair of the Department of Industrial Engineering and Engineering Management at Stanford University for 10 years (1982–92), I'm stepping down. I am on sabbatical this coming year, and will return to teaching and research." ... **Mark E. Martich**, SM '81, has been named VP for technical sales and operations at Isotek AG in Winterthur, Switzerland. Previously, he served as director of engineering at the Wabash Corp. in Providence, R.I.

J. Thomas Selldorff, SM '59, is group VP for systems and equipment at Sanborn, Inc. Prior to holding this position, he was VP for business development at the Wrenthan, Mass.-based company. ... **David M. Himmelblau**, '47, the Paul D. and Betty Robertson Meek and American Petrofina Foundation Centennial Professor in Chemical Engineering at The University of Texas at Austin, has been named recipient of the Founders Award given by the American Institute of Chemical Engineers (AIChE). In honoring Himmelblau, the institute's governing council cited his outstanding contributions in fault detection, optimization, and process control research and education. Himmelblau, who joined the University of Texas in 1957, received a gold medal, a plaque, and a $3,000 stipend. ... **Dimitris Bertsimas**, SM '87, PhD '88 (XVIII), Course XV associate professor, has been named to the first **E. Pennell Brooks** '17 Professorship in Management at the Sloan School. The Brooks chair was established last fall to honor the first dean of what was then called the MIT School of Industrial Management. Penn Brooks served as dean from 1952–59. He died in 1991 at the age of 96. Bertsimas works in two general problem domains—queueing theory and combinatorial optimization. In queueing, his research applies to the design and operation of manufacturing systems, transportation and telecommunication networks, and customer service systems. He has developed algorithms for analyzing the steady state and transient behavior of multi-server queueing sytems. He has generalized Little's Law, the fundamental relationship between the length of a queue and the waiting time in a queue. Currently he is developing an analysis of queueing networks based on the idea of queueing laws, and algorithms to schedule and route jobs within a queueing network. In the field of combinatorial optimization, Bersimas has conducted pioneering work on the probabilistic analysis of combinatorial models and algorithms. Combinatorial optimization problems arise in many decision-making contexts including scheduling, manufacturing, and logistics, and are notoriously difficult to solve. Bertsimas joined the Sloan faculty in 1988. ... **Andrew W. Lo**, associate professor of finance in the School of Management, has received a fellowship of $30,000 from the Alfred P. Sloan Foundation.

David H. Bowen, SM '78, of San Jose, Calif., died on May 14, 1992. Bowen was a consultant and publisher of the *Software Success Newsletter*. ... The Association of Alumni and Alumnae has been notified of the following deaths: **Brandon L. Minor**, SM '77, of Tacoma, Wash., on March 1, 1992; **Etienne R. Aberth**, SM '60, of Yonkers, N.Y., on January 19, 1991; **Leslie A. Rippel**, SM '78, of Westport, Conn., on August 27, 1992; and **R. Joyce Harman**, '45, of Lake Havasu City, Ariz., on October 1, 1992. No further information was provided.

Sloan Fellows



Robert Smiley

Robert "Ed" Smiley, SM '67,has been named director of Civil Space Operations at Mitre. In this new position, Smiley assists in the oversight and continued development of Mitre civil space initiatives from NASA and other civil and international agencies. He also supports various other center initiatives as part of its senior management team. Most of Smiley's career has been spent in the space operations area. For the past two years, he was VP of systems engineering and integration for the Grumman Space Station Program Support Division. He first joined Mitre in April 1988 as associate technical director of the Space Systems Division, advancing to technical director later that same year. Before joining Mitre, Smiley was VP of government communications programs at RCA American Commmunications, Inc.

From Sunnyvale, Calif., **Alan J. McMillan**, SM '91, writes: "I was recently named VP for North American sales at the Software Publishing Corp. in Santa Clara. We publish a variety of PC software products including Harvard Graphics and Superbase." ... **R.P. Clagett**, SM '67, is a lecturer in the Management Department at the University of Rhode Island. He reports: "I'll be traveling (Alaska for five weeks this spring), cruising our sailboat, and lecturing grad classes. I have also started a little consulting plus committee work through the National Research Council=busy!" ... **David Winterhalter**, SM '74, sends word from Rockville, Md., "I retired from NASA on January 1, 1993, after 34 years." ... **Ronald L. Turner**, SM '77, remains president and CEO at GEC-Marconi Electronic Systems, Inc., in Wayne, N.J. ... From Naples, N.Y., **Peter D. Smith**, SM '67, sends news: "I fully retired on May 1, 1992. Sold my manufactuers' rep firm (Pete Smith Associates) in '91, and stayed one year as a

consultant. I'm spending four months in Quebec and then plan to travel the U.S., including Alaska and Canada for the next year at least." . . . **Reuben O. Schlegelmilch**, SM '55, reports from Annadale, Va.: "I retired as technical director in the office of R&D at the U.S. Coast Guard Headquarters in the Department of Transportation. I've been a professional engineering consultant (part-time) since 1986."



Vivien Crea

Commander **Vivien S. Crea**, SM '92, took command of the Detroit Coast Guard Air Station at Selfridge Air National Guard Base, Mich. She is the first woman to lead an aviation unit in the Coast Guard's 202 year history. Prior to that, she served as the operations officer at CGAS Borinquen, Puerto Rico. Crea's new station responds to more than 200 search and rescue cases each year and is credited with saving more than 1,000 lives since 1966.

From Rancho Santa Fe, Calif., **Stanley Pappelbaum**, SM '79, writes: "I am now in the seventh year of my health care consulting practice specializing in cancer center development and medical staff mergers for large not-for-profit hospitals in California and Hawaii." . . . **Dick C. Millar**, SM '84, is manager of propulsion development in the Propulsion Systems Division at Boeing Commercial Airplane Co. in Seattle, Wash. He reports: "Working the Boeing 777 development is a real eye-opener. The resources committed and management task is unbelievable." . . . **James Anderson**, '73, writes that he continues to live in Dover, Mass., and work as a private investor. . . . **E.R. Mathews**, SM '71, retired from Lockheed Space Operations in June 1992. . . . **Bruce F. Becker**, SM '70, retired after 36 years with Eastman Kodak Co. **Robert "Ed" Smylie**, SM '67, has been named director of Civil Space Operations at Mitre. In this new position, Smylie assists in the oversight and continued development of Mitre civil space initiatives from NASA and other civil and international agencies. He also supports various other center initiatives as part of its senior management team. Most of Smylie's career has been spent in the space operations area. For the past two years, he was VP of systems engineering and integration for the Grumman Space Station Program Support Division. He first joined Mitre in April 1988 as associate technical director of the Space Systems Division, advancing to technical director later that same year. Before joining Mitre, Smiley was VP of government communications programs at RCA American Communications, Inc.

G. William Bates, SM '84, is VP for medical eduation at the Greenville Hospital System in Greenville, S.C. He reports: "I was a coauthor of *Obstetrics and Gynecology for Medical Students* (1992). I was elected to the American Gynecological and Obstetrical Society in 1992."

William J. Dowling, SM '86, was named VP for Engineering, Research and Development. He most recently served as the assistant postmaster general of operations support for the Postal Service's northeast region. In his new job, Dowling oversees all engineering and research efforts. His responsibilities include directing all engineering and acquisition support functions, including the design and development of new automation, mechanization systems, and vehicles. Dowling joined the Postal Service as an industrial engineer in 1970 and later served in regional management positions in both maintenance and logistics.



William Dowling

Cheryl L. Clarkson, SM '90, has been named to the board of directors at Peer Review Analysis, Inc., in Malden, Mass. She continues as finance principal at Bank House International Ltd. in Boston. . . . **Oren G. Shaffer**, SM '85, has resigned as executive VP and CFO at the Goodyear Tire & Rubber Co. in Akron, Ohio. . . . **Robert H. Peterson**, SM '76, has another title. In addition to senior VP of Sunshine Precious Metals, he has been named senior VP of Sunshine Mining Co, the Boise, Idaho,-firm's parent company. . . . **Aurelio Madrazo**, SM '74, president of MMM Enterprises, Inc., has been named chair of International Testing Services, Inc. Both companies are located in Houston, Tex. . . . Effective December 31, 1992, **Ormand J. Wade**, SM '73, retired as vice chair of American Information Technologies Corp. (Ameritech) in Chicago, Ill.

The U.S. Postal Service in Washington, D.C., has named three MIT alumni to managerial positions.



Deborah Bowker

Deborah K. Bowker, SM '89, was named VP for communications. In this capacity, she has executive responsibility for external messaging efforts with the media and postal customers, and internal communications programs reaching 730,000 postal workers and managers across the nation. Bowker joined the Postal Service in March 1981 as a senior government relations representative for communications. In January 1993, she was named assistant director of the office of E-COM operations, and in November 1983 she returned to the Government Relations Department, again as a senior representative. Bowker was named general manager of the Public and Employee Communications Division for the Postal Service's southern region in Memphis, Tenn., in January 1985, and was promoted to regional director for marketing and communicaitons in the Southern Region in June 1986. Bowker became an officer of the Postal Service in June 1989 with her promotion to assistant postmaster general of communications at postal headquarters.



Ann Robinson

Ann McKernan Robinson, SM '83,was named consumer advocate and VP in the restructured U.S. Postal Service on August 21, 1992. She has served in the position of consumer advocate since March 16, 1985. Under her direction are the expanding customer satisfaction and independent service performance measurement programs. Robinson determines the effectiveness of all service measurement systems and recommends appropriate changes and adjustments when necessary. As the representative of the individual mail user, she provides the postmaster general an independent evaluation of service. In addition, Robinson's department responds to customers through the award-winning National Consumer Service Card Program, telephone calls and individual letters addressed to the postmaster general or the consumer advocate. She guides responses to consumer feedback—undertakes corrective action where necessary—and analyzes the feedback to develop and implement service improvement programs. Robinson joined the postal service in 1966 as a management intern. She was systems analyst in the Office of Management Systems and later managed the employment and placement, distribution procedures, and international mail classification division at postal headquarters.

Augustus T. Ashton II, SM '71, of Westborough, Mass., died on October 14, 1992. He spent his entire career in the information technology industry, holding marketing and sales positions with Digital Equipment Corp., Wang, Data General, and Honeywell, Inc. He was also a member of the Boston chapter of the U.S. Naval Academy Athletic Association. . . . **Robert C. Ernest**, SM '59, of Neenah, Wisc., died on August 6, 1992. Ernest served in the Army Signal Corps during WWII. He joined Kimberly-Clark in 1952 as a personnel trainee at the Lakeview Mill in Neenah. In the following years he held various positions in mill and brand product management. In 1965 he became managing director of Kimberly-Clark Australia Pty. Ltd., and returned to Neenah in 1970 to direct U.S. Paper and Specialty products operations and worldwide consumer products operations. Ernest was elected to the board of directors of Kimberly-Clark Corp. in 1971, executive VP in 1972, president in 1978, and vice chair of the board in 1985. He retired from the company in 1988. He was a director of Ameritech, Outboard Marine Corp., and Associated Bank of Neenah, a member of the Endowment Committee of the Bergstrom-Mahler Museum, and a former trustee of Ripon College. . . . **Franklin W. Mohney**, SM '61, of New York, New York, died on May 2, 1991, of complications from prostate cancer. He was president of Venture Components in New York City.

Senior Executives

From St. Davids, Pa., **E.P. Lewis**, '72, writes: "I retired from AT&T in 1984 as area VP of the Mid-Atlantic Region. I have worked for Henkels & McCoy, Inc., for eight years as project manager and in marketing/sales." . . . **Roger Onorati**, '81, reports: "Following relocation to Annapolis last summer, my new business as a consultant specializing in behavioral analysis and organizational development is doing well. The Washington area is a great place to have a business, even during a recession." . . . From Bloomfield Hills, Mich., **John P. Vacketta**, '76, sends word that after 36 years of service with General Motors, he retired on September 1, 1992. Vacketta's last position was as group director of finance for auto components. . . . An update from **Asad M. Madni**, '90: "After 18 years with Systron Donner Corp. (where I was in the capacity of chair, president, and CEO), I have joined BEI Electronics, Inc., as president and CEO of BEI's Sensors and Controls Group. My new position started October 1, 1992." . . . **S.M. Shahed**, '87, continues as institute engineer at Southwest Research Institute in San Antonio, Tex. . . . **Paul W. Emlor**, '63, reports: "After 16 years of retirement and 45 years in Chatham, N.J., we are moving to Winston-Salem, N.C." . . . In July 1992, **Michael A. Grimaldi**, '87, was promoted to finance director of North American Marketing Operations at General Motors in Bloomfield Hills, Mich. . . . From Atherton, Calif., **David W. Brown**, '80, sends word: "I've left Digital and am providing management consulting services to presidents of small to medium-sized manufacturing companies, specializing in turnarounds, downsizing, and general management issues of profitability, customer service, and customer satisfaction. Mary and I have two small children, Laura, 4, and Jenny, 6, and we are enjoying Northern California after many years in the Boston area." . . . **Wylie B. Hogeman**, '74, writes: "I retired twice. First from Monsanto as president of Monsanto Research Corp., and secondly as president and CEO of Danis Industries, both located in Dayton." . . . **Palmer L. Moe**, '91, resigned as president and CEO of Valero Energy Corp. in San Antonio, Tex. . . . **Paul O'Friel**, '63, has been reappointed a director emeritus of the board of directors and an overseer of the St. Marguerite d'Youville Foundation of Youville Hospital & Rehabilitation Center in Cambridge. O'Friel, a Newton, Mass.-based attorney, is also a board member of the Massachusetts

Association of the Blind and the St. Elizabeth's Hospital Foundation.

The Association of Alumni and Alumnae has been notified that **George J. Duffy**, '67, of Medford, Mass., died in 1987. No further information was provided.

Management of Technology Program

Lo-Hou (James) Chew, SM '88, is president of H&Q, Taiwan Co., Ltd. in Taipei, Taiwan, R.O.C. . . . **Kee-Joo Tan**, SM '88, is division manager at Singapore Telecommunications Pte Ltd in Singapore. He is responsible for sales and marketing of telecommunication services to all business customers in Singapore. . . . **Kip Steveley**, SM '90, is chief engineer at the Delco Chasis Division of GM Corp. in Rocheter, N.Y. . . . **Mike Beasley**, SM '91, has a new position at IBM, running an internal business venture within IBM. . . . **Lyle Hart**, SM '92, is manufacturing business area manager for High Volume Systems at the IBM PC Co. in Raleigh, N.C. . . . **Takao Kase**, SM '92, is area engineering manager at Delco Electronics in Japan.—Fay Wallstrom, MOT Program, MIT, Room E56-304, Cambridge, MA 02139.

XVI AERONAUTICS AND ASTRONAUTICS

From Southampton, N.Y., **James W. Neighbours**, '41, reports: "Now that I have retired, my wife, Betty, and I enjoy traveling. In the past few years we have enjoyed trips to Scotland, England, Norway, Denmark, Sweden, Finland, Australia, New Zealand, Italy, and Sicily. This past May we spent a very interesting month in Russia as a part of the Elderhostel Program. We had lectures on all sorts of subjects at Moscow University and at teachers colleges in Novgorod and Pskov. We enjoyed many cultural events, toured a great many historic shrines, cathedrals, museums, etc. On two occasions we enjoyed dinner with Russian families in their homes. A most interesting experience." . . . **Paul DiDomenico**, SM '91, writes: "I am a lieutenant in the Air Force, stationed at Los Angeles Air Force Base, Calif., where I am a project engineer in the Global Positioning Systems (GPS) Program Office. GPS is a worldwide, satellite-based navigation system. Although the satellites are developed and maintained by the Air Force, the navigation signals are available to civilian and commercial users as well as the military. GPS is being hailed as 'the next utility,' as it will revolutionize navigation in the future." . . . **Kenneth B. Lazarus**, SM '89, PhD '92, reports: "I started Active Control Experts (ACX), Inc., in June 1992. ACX engineers precision alignment and vibration control components and systems. Engineering services include system requirement, modeling, design, analysis, and prototype fabrication. ACX is also developing a line of medical-device and machine-tool products based on controlled-structures technology."

Marc P. Genain, SM '75, writes from St. Germain-en-Laye, France: "I have been working on the Channel Tunnel UK/FR Trans Manche Link as senior consultant and project manager in the field of operations/control and communications. The system integration is entering the final phase of commissioning—a very interesting phase where installation of equipment designed for heavy rail traffic undergoes tests and trials able to clear it for a long period of operation. The profitabililty of the system depends heavily on a relatively small amount of investment (2.5 billion F. francs/85 billion F. francs)." . . . From Pasadena, Calif., **William P. Kennedy**, SM '36, writes: "I have married again, to Alice Frost Kennedy, on March 21, 1992. She went to Smith and graduated from California, Berkeley." . . . **Yasushi Nozawa**, SM '61, ScD '68, reports: "After more than 20 years of absence, I recently returned to the aerospace field again. I am developing special temperature sensors for space station, aircrafts, and other aerospace applications as an engineering manager at RdF Corp. in Hudson, N.H." . . . In Buenos Aires, Argentina, we receive word from Brigadier **Malcolm C. Paradelo**, SM '44: "I'm 80 years of age, since the 28 of July, 1992, and for the last 10 years, I've been director apoderado of Ormas, S.A. This enterprise controls the following, Molobo; Lofrah; Electronica; Arcom; Cliba, Ing.; Clima, Ing.; Presur; Ayres, Ing.; Sur, Ing.; Bahia, Ing.; Sol, Ing.; Colslim, Ing.; and Cocetel del Plata, S.A."

Charles A. Vehlow, SM '77, is the program director for the McDonnell Douglas Helicopter Co.'s Longbow Apache Program in Mesa, Ariz. . . . **Franklin O. Carta**, '52, SM '53, has been named VP of ASME's International Gas Turbine Institute. He previously served as chair of the institute's board from 1988–89. His current term runs from June 1992 to June 1994. Carta has spent his entire career at the United Technologies Research Center in East Hartford, Conn., conducting and leading aerodynamic research relevant to the gas turbine industry. The author of more than 80 reports and papers, Carta holds several patents in the field of aerodynamics. . . .



Richard Schulte

Richard J. Schulte, SM '64, has been named senior VP at American Gas Association Laboratories in Arlington, Va. Schulte was previously a VP at the Labs. As senior VP, Schulte is responsible for the operation of AGA's gas appliance certification and research programs and for administrative support of three national standards committees accredited by the American National Standards Institute. Schulte is credited with expanding the Labs' programs to provide services on an international basis. He joined the Labs in 1984. He previously served as a management consultant with Stone & Webster Management Consultants in Denver and New York City and as the first director of the Electric Power Research Institute's electrical systems division. In 1991, Schulte was selected as the AGA's Marketing Executive of the Year

XVII POLITICAL SCIENCE

Steve R. Pieczenik, PhD '82, writes: "My third novel, *Maximum Vigilance* (Warner Books, 1992), received an excellent review in the *Washington Post* (my residence) and has been optioned for a film by Paramount Pictures. The book is a political psychological thriller with coups, more coups, and an unstable president." . . . **Dana Mead**, PhD '67, president and COO of Tenneco, Inc., in Houston, Tex., has been named chair at J.I. Case, a Tenneco subsidiary based in Racine, Wash. . . . His Majesty King Carl XVI Gustaf conferred the Royal Order of the Polar Star, Knighthood First Class, upon **John H. Norton**, '75, Consul for Sweden in San Diego, Calif. The Royal Order of the Polar Star was instituted in 1748 by King Fredrik I of Sweden, and is one of Sweden's highest honors, bestowed upon individuals who have been of significant service to the country. Sweden has maintained a consulate in San Diego since 1888. Like all but three of Sweden's 35 consulates in the U.S., the post is headed by a non-career consular official—a citizen of the U.S. who is given full consular powers by the 1963 Vienna Convention on Consular Relations and who is formally recognized by the U.S. State Department as a foreign consul in addition to his or her civilian duties. Norton's career has been in international business. For the last 17 years he has headed the International Resource Center, an overseas market research firm. He is a frequent writer and speaker on international business topics. He teaches as an adjunct professor at San Diego's National University and other institutions. Norton has served as Consul for Sweden since 1984.

Natalie J. Goldring, PhD '84, and Stephen Alexis Cain contributed a chapter entitled "The Defense Budget After the Cold War," to *The New World Order: Rethinking America's Global Role* (1992), edited by Carol Rae Hansen . . . **Kenneth A. Oye**, a Course XVII associate professor, was appointed director of the Center for International Studies (CIS) on July 1, 1992, succeeding Professor **Myron Weiner**, who has served as director since 1987. Oye is a specialist on international political economy and American foreign policy. His major study of international economic cooperation and conflict during the great depression and in the eighties, *Economic Discrimination and Political Exchange*, was published last year by Princeton University Press. The book challenges conventional wisdom about the role that bilateral bargaining and diplomacy played in the evolution of the crisis of the thirties. Oye may, however, be best known by students and senior scholars alike for the Eagles series he edited: four volumes on American foreign policy that track U.S. policy from the end of the seventies, *Eagle Entangled*, through the Reagan era, *Eagle Defiant*, and *Eagle Resurgent*, and most recently in the years after the end of the Cold War, *Eagle in a New World*.

Richard J. Samuels, PhD '80, was appointed to the Ford International Professorship in Political Science last July, and succeeded Professor **Suzanne Berger** as head of the MIT Department of Political Science last September. The Ford International Chair Professorships were established to encourage research and scholarship in the international aspects of such areas as political science, economics, history, management, and urban studies. The chair was previously held by **Lucian Pye** from 1972 until his retirement this past June. Samuels is widely recognized as one of the country's leading experts on contemporary Japan and the author of several influential studies. His book, *The Business of the Japanese State: Energy Markets in Comparative and Historical Perspective* (1987), received the Ohira Foundation Prize. Currently, he is completing a book on the Japanese technology process. He joined the faculty as an assistant professor in 1980, and has been unusually effective as an organizer of Japan-related activities, having participated actively in the Industrial Liaison Program's Japanese efforts, as well as creating the MIT-Japan Program.

Karl W. Deutsch, of Cambridge, died of cancer in his home on November 1, 1992. He was professor of government emeritus at Harvard University and a former president of the American Political Science Association. Deutsch was an innovator in applying quantitative methods to social-science research and in assembling data on population movements, languages, and international trade. He helped to establish several institutions to collect data, including the Yale Political Data Program and the International Institute for Comparative Social Research of the Science Center in Berlin. After WWII he taught at MIT from 1945–56.

XVIII MATHEMATICS



Frederic Bien

Frederic V. Bien, PhD '86, was presented with a Princeton University award for excellence in teaching at the university's 1992 commencement exercises. Bien, former assistant professor of mathematics, specializes in the theory of group representations. At Princeton from 1986 until June 1992, he taught courses in multivariable calculus, linear algebra, differential geometry, number the-

ory, and algebraic geometry, often emphasizing the relation of mathematics to areas of study as varied as the arts and natural sciences. Bien, who is now associate professor of mathematics at the University of Utah at Salt Lake City, is teaching for the 1992–93 academic year at the University of California at San Diego. . . . *Riemannian Geometry: A Beginner's Guide* (Jones and Bartlett Publishers, 1993), is a new book by **Frank Morgan**, '74. According to its jacket, the book "studies curvature in general dimensions. By working in R^n, the author provides an intuitive, easy introduction to the fundamental concepts, from the metric to the Riemannian curvature tensor." Morgan is at Williams College as professor and chair of the Mathematics Department.

Margaret Tuttle, SM '89, has been hired as a member of the piano faculty at Indian Hill Arts in Littleton, Mass. She will be teaching beginning and intermediate students of all ages. . . . **Sheldon Chang**, Course XVIII assistant professor, has been selected to receive a $30,000 fellowship from the Alfred P. Sloan Foundation.

XXII NUCLEAR ENGINEERING

From Athens, Greece, **Ioannis A. Papazoglou**, SM '74, ScD '78, writes: "I continue to direct the Institute of Nuclear Technology-Radiation Protection of the National Research Center 'Demokritos' in Athens, Greece. At the same time I am actively involved in R&D in the area of risk assessment and evaluation in nuclear and non-nuclear systems." . . . From **Guy Sasson**, SM '90, in France: "It's been two years since I've joined the Societe des Petroles Shell. I am working in the Lubricants Division and my mission is to develop the industrial lubricants marketing strategy. It's a very challenging job for this mature market is going to see tremendous changes as Europe will become (I hope, today is the referendum day) the biggest market in the world. However, we have to be prepared for any outcome in building our strategy. I can say that my PRA background I studied at MIT with Dr. **Nathan O. Siu** in the Nuclear Engineering Department has been a great source of inspiration on studying the scenarios and the robustness of our strategy." . . . **Susan Plomgren**, SM '88, sends word from San Francisco where she is a research associate at Imatron, Inc.: "Imatron's Ultra Fast CT Imaging machine can non-invasively detect coronary calcification, an early indicator of atherosclerosis. See *New York Times* article on Sunday, August 23, 1992. Since for many of the 1.5 million people in America who have heart attacks annually, the first symptom is death, the need for an early indicator is very compelling." . . . From Paris, France, **Eric E. Sasson**, SM '87, writes: "Already 5 years since I left MIT and Boston. The good news is that my wife is pregnant—by the time you read my note, she might have already given birth. I'm still working for Compagnie Bancaire, but the times are hard!" . . . **William R. Corcoran**, PhD '71, reports: "I am still with Tenera, L.P., as a VP doing corporate level nuclear safety oversight and review work. I am the chair of the Nuclear Review Board for South Texas Project and am a member of similar committees for six other nuclear stations. One of my specialities is utility self-assessment, which was the subject of my lecture for last year's MIT Nuclear Reactor Safety Summer Course. I was able to attend the MIT Course XXII reception while I was in Boston to present papers at the ANS meeting. I was very pleased to renew old acquaintanceships and meet new members of the Department." . . . **Andrew G. Cook**, SM '76, NUE '76, PhD '78, writes from Simsbury, Conn.: "I joined ABB as a regional sales VP in the Power Plant Systems group. We have had an excellent year and anticipate that soon even MIT will be the proud owner of one of our gas turbines." . . . In Bethesda, Md., we receive word from **Achilles G. Adamantiades**, PhD '66 who is a senior power engineer at the International Bank of Reconstruction and Development: "I have been transferred to the new Department 3 of the Europe and Central Asia Region, covering the countries of the former Soviet Union. My responsibilities are focused on energy issues and projects with emphasis on electric power systems. I have primary responsibility for the Baltics and Belarus and secondary for the Ukraine. As a nuclear engineer, I monitor developments and advise the World Bank management on nuclear power issues throughout the world. Safety concerns in the countries of the former Soviet Union (as well as in Bulgaria and Czechoslovakia) are at the center of the current nuclear international activities." . . . In October, Major **Michael R. Helmick**, SM '88, sent word: "After completing a three-year assignment as associate professor of mechanical engineering in the Department of Civil & Mechanical Engineering (formerly Department of Mechanics) at the U.S. Military Academy at West Point, and the birth of our fist child, Stephanie, Gina and I spent this past year at the Command and General Staff College in Kansas. I completed my work toward a master's degree in military arts and sciences and was promoted early to major. We have since moved to Fort Hood, Tex. I am now a war plans staff officer and Gina is expecting our second child in January 1993." . . . General **Joseph P. Franklin**, SM '61, reports from Swanton, Md.: "I retired from the U.S. Army in 1987 as a major general (Commandant of Cadets at USMA West Point 1979–82). I was chief of U.S. Military Mission in Spain from 1983–87. I founded a business consulting company in Madrid in 1987 called Franklin SA. It specialized in U.S. investments and joint ventures in Spain. In October 1992 I was named special consultant to the board of directors at Frequency Electronics, Inc., in Mitchel Field, N.Y." . . . **James K. Liming**, SM '88, writes: "I am an engineering and management consultant with Erin Engineering and Research, Inc. We perform risk and reliability analysis for industry and government worldwide. Currently, I manage the company's Southern California office in Mission Viego, Calif." . . . From Daejon, Korea, **Soon Heung Chang**, SM '80, PhD '81, reports: "I am a professor in the Nuclear Engineering Department at the Korea Advanced Institute of Science and Technology. I have recently been appointed as a member of the International Nuclear Safety Advisory Group, which is an advisory group to the director general of the International Atomic Energy Agency in the field of nuclear power reactor safety." . . . **Allen G. Croff**, SM '74, NUE '74, of the Department of Energy's Oak Ridge National Laboratory (ORNL) has been elected chair of the Nuclear Development Committee of the Organization of Economic Cooperation and Development's Nuclear Energy Agency. Croff, associate director for waste and environmental programs in the Chemical Technology Division, will serve for an indefinite term. The Nuclear Development Committee conducts technical and economic studies on nuclear energy development and the fuel cycle, while providing a forum for information exchange and coordination of nuclear activities. . . .



Daniel Wilkins

Daniel R. Wilkins, SM '63, ScD '66, has been awarded the 1992 George Westinghouse Gold Medal by ASME for "25 years of distinguished contributions to the design, development, and construction of nuclear power plants, especially Boiling Water Reactors; and for demonstrated leadership in providing a vision and firm path for the development of the next generation of nuclear power plants in this era of standardization, enhanced safety, and increasing globalization of the power industry." Wilkins is general manager of GE Nuclear Energy's Nuclear Services and Project Department in San Jose, Calif. In this position, he is responsible for operating plant services and new plant projects for GE's nuclear energy business. Prior to his current position, Wilkins was responsi-

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OF COUNSEL
Joseph Zallen, '39

ble for GE's advanced boiling water reactor program. He was previously general manager of the Nuclear Power Systems Engineering Department, responsible for design, development, and technology support of GE's commercial boiling water product lines. In his 25 years with GE, he has held positions in direct energy conversion, breeder reactor development, nuclear fuel development, quality assurance, and reliability engineering. . . . Course XXII Professor **Allan F. Henry** has been selected to receive the 1992 Eugene P. Wigner Reactor Physicist Award from the Reactor Physics Division of the American Nuclear Society, in recognition of his contributions to nuclear reactor physics. He also received a technical achievement award from the ANS earlier this year. In addition, the MIT Student Chapter of the ANS received the Samuel Gladstone Award for being the most active chapter. . . . On November 17, 1992, the MIT Nuclear Engineering Department held a reception honoring the 35th anniversary of the establishment of the department and its founding head **Manson Benedict**, SM '32, PhD '35 (V). The event, which attracted nearly 80 alumni, was held in coordination with the American Nuclear Society Meeting held in Chicago from November 15–20. Benedict, who resides in Naples, Fla., is Institute Professor Emeritus at MIT.

TPP TECHNOLOGY AND POLICY PROGRAM

Alexander Demacopoulos, SM '83 (I), SM '84, SM '87 (XV), PhD '89 (I), is now the deputy governor of the Hellenic Industrial Development Bank in Athens, Greece. . . . **David Dorau**, SM '87, and his wife were expecting their fourth child in January 1993 as of this writing. This past summer he spent some time in Australia and traveled to Turkey last October. . . . **Gregg Martin**, SM '88 (I), SM '88, PhD '92 (I), received an MA in national security and strategic studies at the U. S. Naval War College in Newport, R.I. His dissertation was completed in June 1992 and he earned a PhD in September in an interdepartmental program with Professors Fred Moavenzadeh in Course I and Harvard Sapolsky in Course XVII. Gregg is now assigned at the Engineer Operations at the Army's I Corps in Fort Lewis, Wash. . . . June was a busy month for **Hauke Kite-Powell**, '84 (XIII), SM '86 (XIII), SM '88, PhD '92 (XIII). He received a PhD in Ocean Systems Management from MIT and got married to Soo-Sheung Wong. They recently bought a house on Cape Cod, Mass., where Hauke is a research associate at Woods Hole Oceanographic Institute. . . . **Bertil Chappuis**, '88 (X), SM '89, has most recently been the Technology and Policy advisor to the campaign of Victoria Munoz for governor of Peurto Rico. He worked for a year at TROPICO, a governmental industrial development agency in Puerto Rico, before getting an MBA at Stanford University. . . . **Qiang Xue**, SM '88 (XV), SM '89, PhD '91 (II), is in charge of technology management planning for BOC, a multinational firm with operations in over 60 countries. . . . **Philippe Rose**, SM '90, is working on strategic planning, investment strategy, and environmental affairs for ICI Polyurethanes in Belgium. . . . The rumor that **Steve Schondorf**, '88, SM '92 (XVI), SM '92, is engaged is now confirmed. Steve will be getting married in June 1993. Congratulations! Steve is working on Ford's electric vehicle program to meet the California laws for zero emission vehicles by 1998. He is in the office focusing on how to apply aerospace engineering techniques to a high-technology, low-volume production project.—Richard de Neufville, TPP, MIT, Room E40-252, Cambridge, MA 02139.

STS PROGRAM IN SCIENCE, TECHNOLOGY & SOCIETY

Deborah Fitzgerald is the 1992 recipient of the Graduate Student Council Teaching Award for the Humanities. In June she was selected as the Class of 1956 Career Development Professor at the Institute. . . . **Loren Graham** gave a talk at Pennsylvania State University on "Technocracy and Technical Advice in the Former Soviet Union" on October 15, 1992. . . . **Hugh Gusterson** was discussant for the panel "Engendering International Communication" at a conference on Transcultural Communication at the University of Chicago, September 12–17. . . . **Evelynn Hammonds**, SM '80 (VIII), presented a talk "Race and the History of Science?" as the opening lecture in the series "Frontiers in African-American Studies" at U.C. Berkeley on October 6. . . . **Lily Kay**'s book, *The Molecular Vision of Life: Caltech, the Rockefeller Foundation, and the Rise of the New Biology* has been available from Oxford University Press since last November. . . . **Evelyn Fox Keller**'s new book, *Keywords in Evolutionary Biology* (co-edited with Elisabeth Lloyd) has just been published by Harvard University Press. Her book, *Secrets of Life, Secrets of Death: Essays on Language, Gender, and Science* (Routledge) has been available since November. . . . **Sherry Turkle** was organizer and moderator for the MIT Communications Forum Seminar, "Seeing is Believing: Media as Evidence" on October 8 and presented "Living in the MUDS: Multiplicity and Identity in Virtual Reality" at the American Anthropological Association Conference in San Francisco in December. . . . **Charles Weiner** presented a paper "Beyond Soundbites and Talking Heads: Using Archival Video in Research in Teaching" in August at the annual meeting of the Society for History of Technology in Uppsala, Sweden. . . . STS/Political Science graduate **Bruce A. Bimber**, PhD '92, has been appointed assistant professor at the University of California at Santa Barbara, effective in the fall of 1993. He is currently working for the Rand Corp. in Washington, D.C.—Graham Ramsay, STS Program, MIT, Room E51-128, Cambridge, MA 02139.

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

Paul A. McGreenery, '18; September 19, 1992; Needham, Mass.
Thomas W. Alder, '22; October 2, 1992; Tubac, Ariz.
Maurice T. Freeman, '25; October 7, 1992; Winchester, Mass.
Dwight K. Taylor, '26; October 4, 1992; Franconia, N.H.
Alfred M. Luery, '30; August 11, 1992; Klamath Falls, Ore.
Charles S. Camplan, '31; September 24, 1992; San Diego, Calif.
Edwin J. Ducayet, '31; May 8, 1992; Fort Worth, Texas
Harold E. Duncan, '31; September 9, 1992; Maywood, N.J.
Sidney Milligan, '31; October 10, 1992; Little Compton, R.I.
Otto A. Putnam, '33; August 26, 1992; Wyomissing, Pa.
Francis S. Doyle, '34; October 8, 1992; Pottsville, Pa.
Arthur J. Miller, '34, SM '35, PhD '39; May 5, 1992; Knoxville, Tenn.
Edward C. Reber, SM '34; 1988; Chambersburg, Pa.
Benjamin T. Salmon, '34; August 3, 1992; Fallbrook, Calif.
John G. Smith, '34; September 22, 1992; Kennebunk, Maine
David N. Truscott, ScD '35; April 11, 1992; Ely Cambs, England
Joe Gratz, '36; June 14, 1992; Tampa, Fla.
Claxton Monro, '36; 1991; Austin, Texas
Curtis Hillyer, Jr., '37, SM '38; September 1992; Short Hills, N.J.
David W. Beaman, Jr., '38, SM '39; August 7, 1992; Poughkeepsie, N.Y.
Robert S. Hand, SM '38; July 25, 1992; Chadds Ford, Pa.
Sidney P. Kodama, '38; April 30, 1992; Shrewsbury, N.J.
William K. Cutten, '39, SM '41; September 19, 1992; Allentown, Pa.
James K. Gilmore, '39; September 17, 1992; Hyde Park, Vt.
John W. Pocock, SM '39; October 19, 1992; Winnetka, Ill.
Gordon A. Pope, '39; October 21, 1992; Center Ossipee, N.H.
Edward S. Carmick, SM '40; September 23, 1992; Saratoga, Calif.
Edward M. Day, SM '40; October 19, 1992; Bethesda, Md.
John R. Kane, SM '40; November 20, 1992; Newport News, Va.
Frederick T. Davies, '41; September 19, 1992; Sargentville, Maine
John M. Sykes, SM '41; February 23, 1992; Roanoke, Va.
John E. Uhlemann, '42; October 15, 1992; Lake Forest, Ill.
Daniel B. Grady, '42; October 4, 1992; La Jolla, Calif.
Robert H. Legg, SM '42; June 28, 1992; Sun City West, Ariz.
Eugene H. Morrison, '42; September 16, 1992; Fort Myers, Fla.
Robert E. Jorgensen, '43; October 19, 1992; Granby, Conn.
Robert B. Rumsey, '43; August 19, 1989; Buffalo, N.Y.
John H. Adams, '44; September 6, 1992; Schenectady, N.Y.
Charles L. Sollenberger, '44, SM '48; June 19, 1992; Egg Harbor, Wis.
Lehi Robert Gardner, '45; September 8, 1992; Cedar City, Utah
R. Joyce Harman, '45; October 1, 1992; Lk Havusa City, Ariz.
Read M. Kuhns, Jr., '46; September 14, 1992; W. Hartford, Conn.
Will Mitchell, Jr., '46; April 27, 1992; Egg Harbor, Wis.
Harold M. Coverdale, SM '47; September 28, 1992; Laguna Hills, Calif.
Samuel Waldstein, '47; September 6, 1992; Waban, Mass.
John W. Colton, '48; March 3, 1987; Des Plaines, Ill.
Edward P. Farnsworth, '48; September 30, 1992; West Los Angeles, Calif.
Richard H. Gaunt, '48; September 9, 1992; Lynn Haven, Fla.
Wilfred M. Howerton, NE '50; July 25, 1992; Davis, Calif.
Stephen F. Temmer, '50; October 8, 1992
William Kell, Jr., '51; October 11, 1992; Sunapee, N.H.
Carl H. Brubaker, Jr., PhD, '52; September 24, 1992; Okemos, Mich.
Philip Hallof, '52, PhD '57; September 21, 1992; Don Mills, Ontario, Canada
Clarence B. Hanford, SM '53; July 22, 1992; Aurora, Ore.
Morrin E. Hazel, Jr., '56; September 14, 1992; Saugus, Mass.
Arthur Dickson Hause, '57, SM '58, ScD '60; September 12, 1992; Summit, N.J.
Ramon A. Suehrstedt, '58; May 2, 1992; Diamond Bar, Calif.
Richard S. Kahan, '59; September 3, 1992; Hartland Four Corners, Vt.
John Z. Raymond, SM '62; September 18, 1992; Philadelphia, Pa.
Ann F. Friedlaender, PhD '64; October 19, 1992; Newton, Mass.
Richard J. Long, '65; September 8, 1992; Endicott, N.Y.
Augustus T. Ashton II, SM '71; October 14, 1992; Westborough, Mass.
Elbert P. Little, Jr., SM '73; October 22, 1992; West Newton, Mass.
Jennifer K. Shakespeare, MAR '77; September 13, 1992; Provincetown, Mass.
David H. Bowen, SM '78; May 14, 1992; San Jose, Calif.
Catherine M. Koza, MCP '90; Littleton, Colo.

CORRECTION: William M. Nicholson, SM '48, was erroneously listed as deceased on page MIT 46 of the July 1992 Technology Review. *Captain Nicholson (USN Ret.) has written to assure us that this is "a condition I have not yet achieved!" We apologize for the error.—Ed.*

The Travel Bug

I am pleased to report that you may notice a familiar problem in one of the new Prentice-Hall catalogues. Bill Zobrist from P-H decided to run one of our "Puzzle Corner" problems. Other than that it has been a pretty quiet month, especially when compared with my "close encounter" with Hurricane Andrew.

Problems

F/M 1. We begin with a Bridge problem from Jerry Grossman who writes: Here's a cute bridge problem that you might want to consider for *TR*. It arose (well, except for one card that I changed to make it more interesting) in a Swiss team game last weekend at the Southeast Michigan Valentine's Sectional.

North
♠ 4
♥ A J 5
♦ A K J 7 2
♣ A 8 5 2

West	East
♠ 9 7 6 5	♠ 3
♥ 5 3 2	♥ K Q 9 8 6
♦ 8	♦ Q 10 9 4
♣ J 10 7 6 3	♣ K 9 4

South
♠ A K Q J 10 8 2
♥ 10 7
♦ 6 5 3
♣ Q

The contract is six spades by South, East having bid hearts (overcalled North's diamond opening bid). How is the contract made against any lead? This is not a double dummy problem, so the play should make bridge sense.

F/M 2. Our next problem is Tom Hansen's first submission, a true-to-life story illustrating that "biology students should learn their physics."

A scientist at a Boston-area biotech company needs to centrifuge 5 identical samples. He has available 3 centrifuges with capacities of 6, 8, and 12 samples. Can he use any of these centrifuges to prepare the 5 samples together, without adding another sample or making the centrifuge unbalanced?

F/M 3. Walter Cluett asks one that sounds very familiar to me. Who knows but maybe it was in "Puzzle Corner" some 20 odd years ago.

Four bugs are standing on the corners of a square surface 1.414 feet on a side. Simultaneously, each starts walking at the same rate directly, and always directly, toward the bug on its right. Eventually they all meet. How far did each bug travel?

Speed Department

Speedy Jim Landau wants to know how you can drop a raw egg 4 feet without it breaking.

Solutions

OCT 1. We begin with a Bridge problem from J. Harmse who notes that the highest possible declarer score is obtained by playing 1NT redoubled vulnerable making all 13 tricks. The problem is to devise a distribution of the cards in which the above occurs with "normal" bidding and play.

The following solution is from Robert Sackheim:

North
♠ x x x
♥ x x
♦ A Q 10 x x x
♣ x x

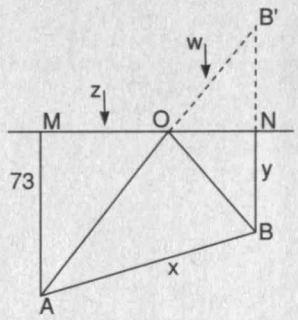
West	East
♠ K J x x	♠ Q x x
♥ K Q J x	♥ x x x x
♦ K J	♦ x x x
♣ x x x	♣ K J x

South
♠ A x x
♥ A x x
♦ x x
♣ A Q 10 x x

South	West	North	East
1 C	Dbl	1 D	Pass
1 NT	Dbl	Pass	Pass
Redbl	Pass	Pass	Pass

OCT 2. The following problem is from Robert Sackheim. A is 73 feet from a straight river, and B is on the same side of the river but not so far from it. M and N are the points on the river nearest to A and B respectively. The length of AB, MN and BN are whole numbers of feet. Joan walks from A to B via the river (i.e., at one point she is at the river), taking the shortest possible route, and this is also a whole number of feet. How far does she walk? What is the direct distance from A to B?

A fine solution from Howard Stern:



Referring to the diagram above, reflect B across MN to B'. The length of the shortest path from A to B, touching the river MN at O, is the same as the length of the segment AB'. Let the small letters represent the integral lengths of the following segments:

x=AB y=BN z=MN w=AB'

By the Pythagorean theorem we have the following relationships:

$$z^2+(73-y)^2=x^2$$
$$z^2+(73+y)^2=w^2$$

Also, since point B is closer to the river (MN) than A, we have the inequality $0<y<73$.

The above conditions imply a Diophantine set of equations. Because of the limits on y, there are only a finite number of Pythagorean triplets that must be checked.

The Pythagorean triplets can be generated from two integers m,n as follows: $\{m^2-n^2\}$, $\{2mn\}$, $\{m^2+n^2\}$, and all integer multiples thereof.

The only solution found is z=120, x=123, w=169, and y=46. Thus, A and B are 123 feet apart, and the distance walked is 169 feet.

OCT 3. Richard Hess entitles this one "The missing term" and writes: Given the series

...,35,45,60,x,120,180,280,450,744,1260,...

the problem is to find a simple continuous function to generate the series and from it to determine the surprise answer for x.

Rick Hedrick, Eugene Sard, and Kelly Woods found the unique 8th degree polynomial passing through the nine given points and deduced that x is approximately 83. The proposer Richard Hess intended that

$$f(n)=\frac{2^n-1}{n}\cdot 120 \quad (n\neq 0)$$

$$x=\lim_{n\to 0} f(n)=120\ln 2$$

Which one is the "simpler," I leave to you.

Other Responders

Responses have also been received from B. Blondin, S. Feldman, M. Fountain, P. Godfrey, R. Hess, J. Keilin, M. Lively, A. Lowenstein, D. Schwarzkopf, and K. Rosato.

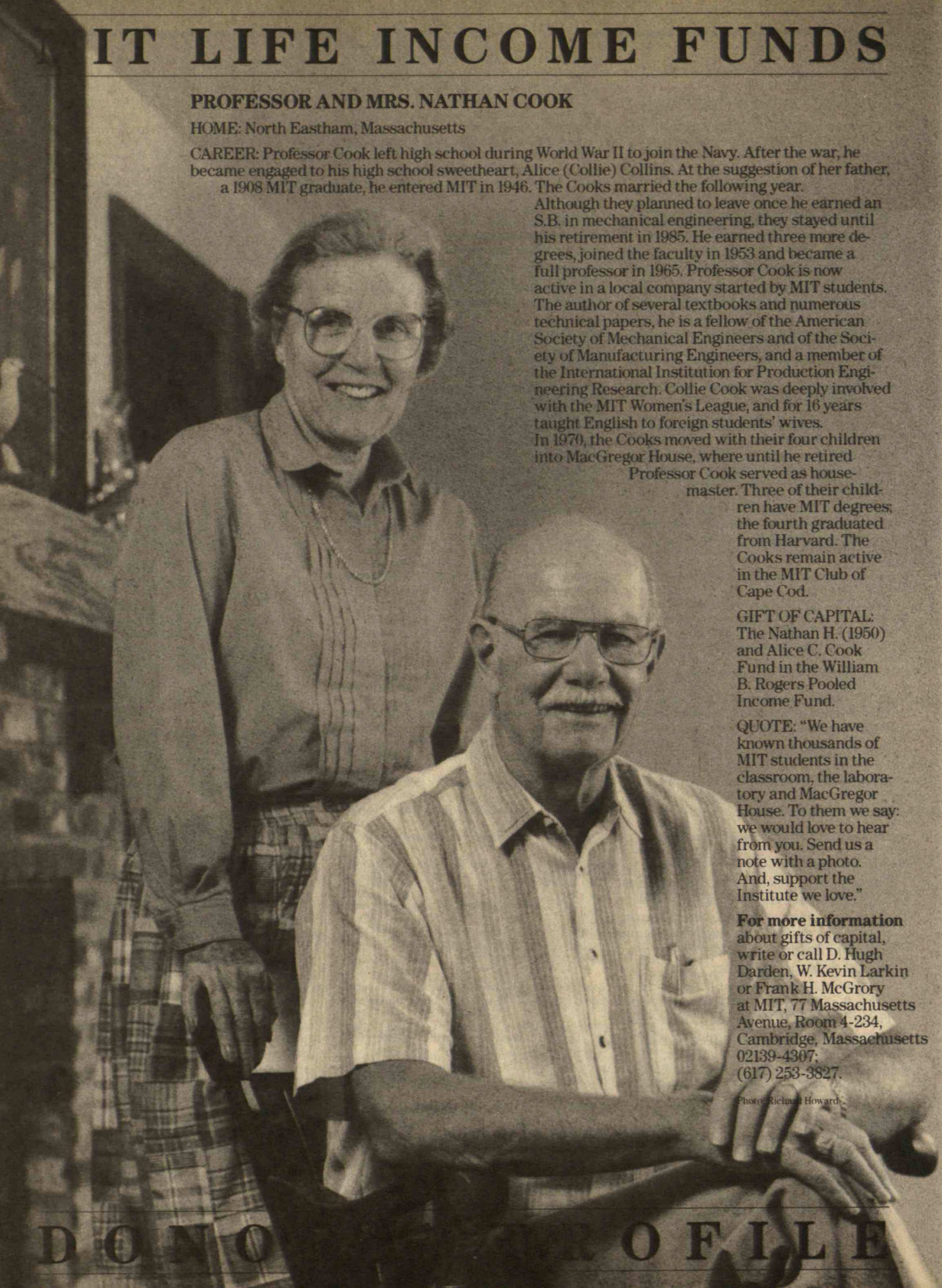
Proposer's Solution to Speed Problem

Drop it 5 feet; it will not break during the first four.



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012, OR TO: GOTTLIEB@NYU.EDU

IT LIFE INCOME FUNDS



PROFESSOR AND MRS. NATHAN COOK

HOME: North Eastham, Massachusetts

CAREER: Professor Cook left high school during World War II to join the Navy. After the war, he became engaged to his high school sweetheart, Alice (Collie) Collins. At the suggestion of her father, a 1908 MIT graduate, he entered MIT in 1946. The Cooks married the following year.

Although they planned to leave once he earned an S.B. in mechanical engineering, they stayed until his retirement in 1985. He earned three more degrees, joined the faculty in 1953 and became a full professor in 1965. Professor Cook is now active in a local company started by MIT students. The author of several textbooks and numerous technical papers, he is a fellow of the American Society of Mechanical Engineers and of the Society of Manufacturing Engineers, and a member of the International Institution for Production Engineering Research. Collie Cook was deeply involved with the MIT Women's League, and for 16 years taught English to foreign students' wives.

In 1970, the Cooks moved with their four children into MacGregor House, where until he retired Professor Cook served as housemaster. Three of their children have MIT degrees; the fourth graduated from Harvard. The Cooks remain active in the MIT Club of Cape Cod.

GIFT OF CAPITAL: The Nathan H. (1950) and Alice C. Cook Fund in the William B. Rogers Pooled Income Fund.

QUOTE: "We have known thousands of MIT students in the classroom, the laboratory and MacGregor House. To them we say: we would love to hear from you. Send us a note with a photo. And, support the Institute we love."

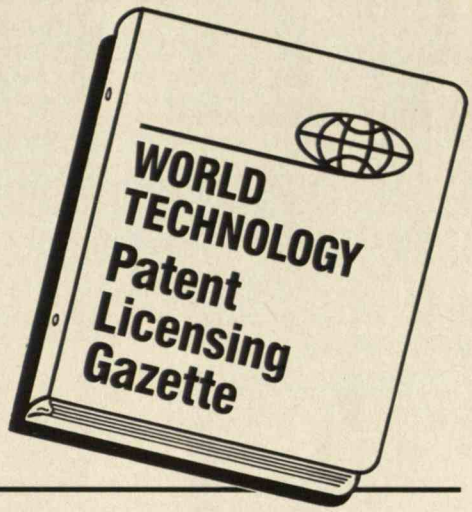
For more information about gifts of capital, write or call D. Hugh Darden, W. Kevin Larkin or Frank H. McGrory at MIT, 77 Massachusetts Avenue, Room 4-234, Cambridge, Massachusetts 02139-4307; (617) 253-3827.

Photo: Richard Howard

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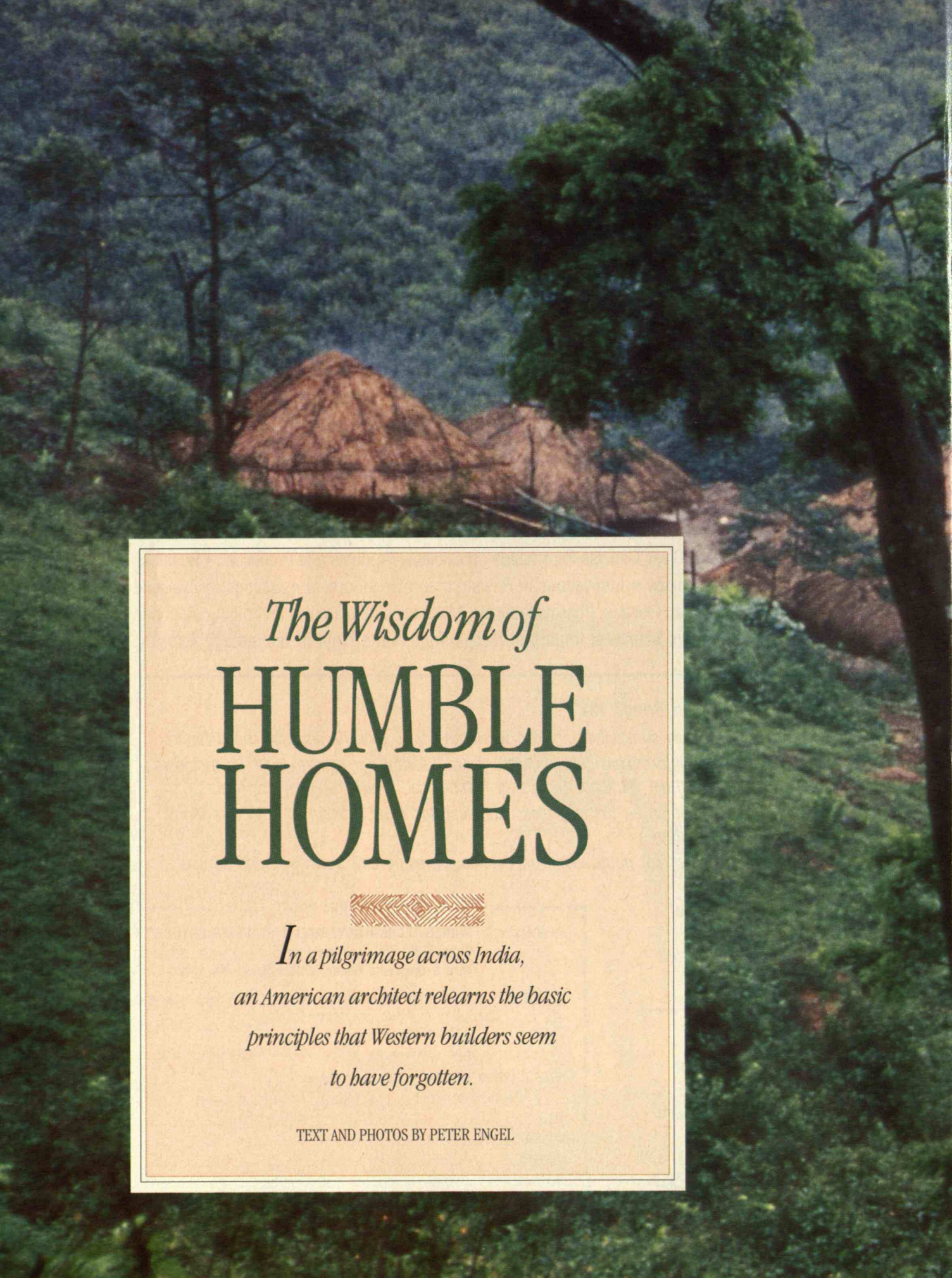
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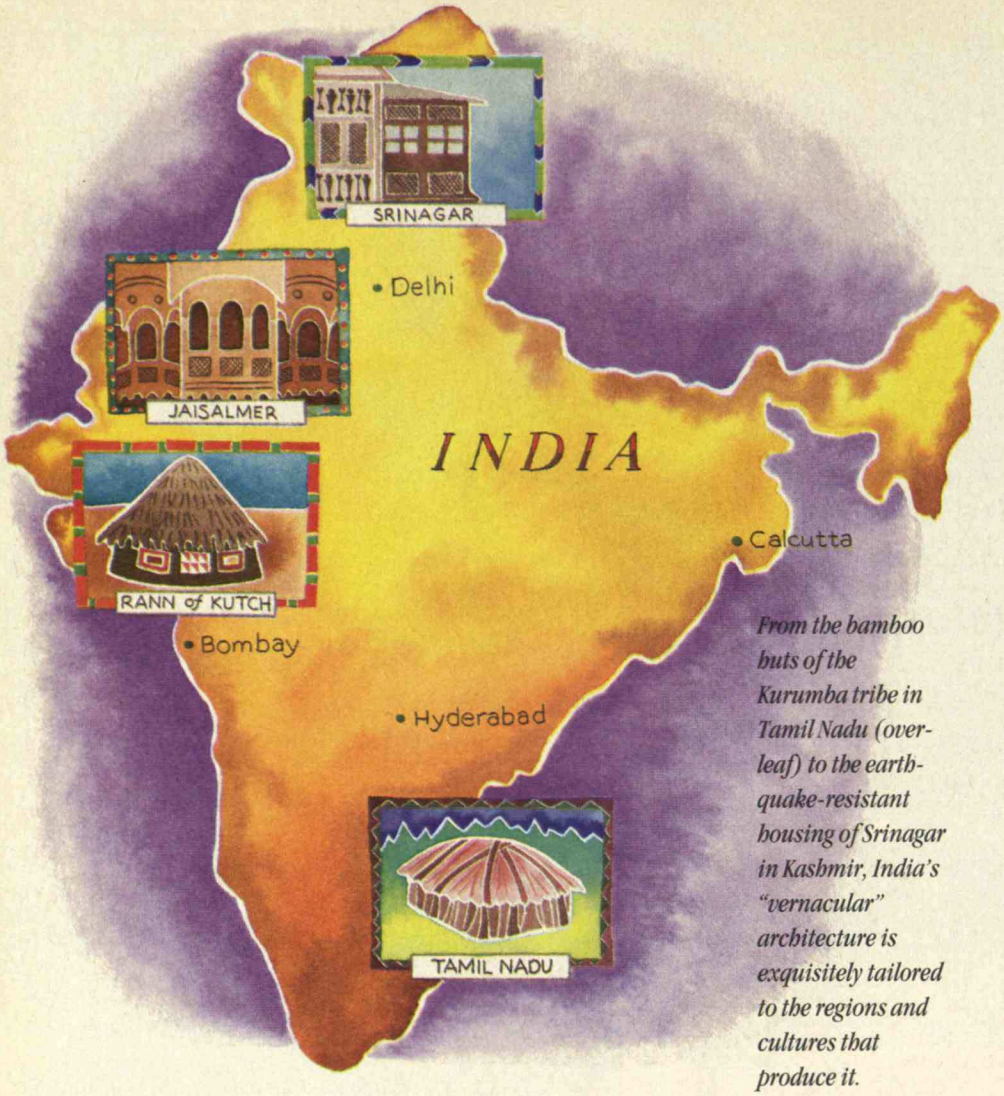


The Wisdom of HUMBLE HOMES

In a pilgrimage across India, an American architect relearns the basic principles that Western builders seem to have forgotten.

TEXT AND PHOTOS BY PETER ENGEL





From the bamboo huts of the Kurumba tribe in Tamil Nadu (overleaf) to the earthquake-resistant housing of Srinagar in Kashmir, India's "vernacular" architecture is exquisitely tailored to the regions and cultures that produce it.

A monsoon rain was pouring as we made our way up the steep hillside toward the village. Mist shrouded the surrounding hills, and it was only where the land dropped below the plateau of haze that the quiltlike pattern of plantations emerged with clarity. Here, in the Nilgiri Hills of Tamil Nadu in southern India, planters had for centuries cleared acre after acre of forest to supply the British Empire with tea. The trees had provided cover for wild animals and forest dwellers, hunting and gathering tribes like the Kurumbas, one of whose villages we were about to visit. Of what had been impenetrable jungle centuries ago, only a few wooded pockets remained.

My wife, Cheryl, and I slogged through the mud, surrounded by scampering Kurumba children. We were two American architects, here to learn how to make a building from people who had never set foot in a classroom. The Kurumbas were not only illiterate: they had never had a written language. For centuries they had taught their children to forage for nuts and berries, to track and kill wild boar and spotted deer, weave baskets, steam rice in a section of bamboo, smoke out the inside of a hut to keep it free of mold and insects, and build an encampment so it would not be attacked by migrating elephants. Along the way, they had imparted a culture's accumulated knowledge of music, art, morality, and religion—all by word of mouth. But now, to keep up with the changes fast enveloping them, they had built a school.

Although the steady downpour made it difficult to keep our eyes on the path, we soon reached the comfort of the new bamboo and thatch hut that served as the schoolhouse. We ducked under the roof overhang and stepped onto the packed mud floor. As we removed our dripping coats, surrounded by giggling children, we surveyed the colorful interior. "The children did the decorations," our guide, Jasintha, explained, showing off the palm-leaf banners that hung from the bamboo rafters. The bamboo was decorated with bright dots and squiggles and stripes. Like everything else in the building, the paint had come from the jungle.

The schoolhouse was a lesson in utility and economy. It consisted of a single large room without partitions. The roof of bamboo and thatch stood on a dozen thick bamboo poles rammed into the earthen floor. As suits a building in an area so wet that it receives not one but two annual monsoons, the roof pitched steeply and came all the way down to eye level. A gap between the roof and the top of the woven bamboo walls allowed air to circulate. Despite the torrent outside, the room was almost bone-dry.

Jasintha introduced us to the builder, who cheerfully explained his technique. The first decision in constructing the schoolhouse was where to put it. Since the school would be shared by families living in clusters of homes on four different sides of the hill, they elected to put the

PETER ENGEL is an architectural designer practicing in Berkeley, Calif. He specializes in low-cost housing and urban design and has written on these and other topics for the New York Times, The New Republic, Smithsonian, Scientific American, *and* Progressive Architecture.

ILLUSTRATION: CYNDY PATRICK

building on the top—"close enough," Jasintha translated, "for every grandmother to call the children home for lunch."

The builder next estimated the size of the room and, without even tracing its outline on the ground, determined the amount of bamboo and thatch he would need to construct the roof and walls. While the women of the village foraged for these materials in their free time, the builder and his teenage son made the packed mud base that would lift the floor above the water as it ran down the hillside. When all the material had been collected, the builder carefully inspected it for durability. The high salt content of fronds from the palmyra tree makes them resistant to insects and rot, he told us, while trees cut down less than two weeks after the full moon may be infested with boring beetles.

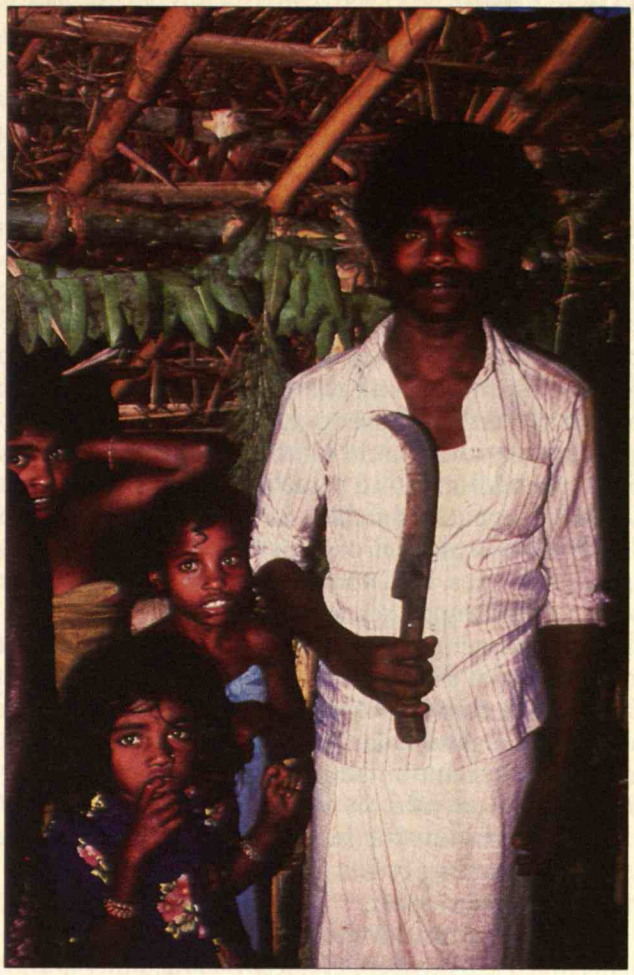
The actual construction went quickly. In a few hours, the builder laid out the placement of the thick bamboo supports, measuring and proportioning by eye. Then, using only a single sicklelike tool, he and his son split, hammered, and trimmed the bamboo and lashed the slender slats with strong, flexible vines. In less than three days, the Kurumbas' schoolhouse was finished.

Learning from the Vernacular

In 1989 I traveled throughout India to study the extraordinary "vernacular" architecture of a country as diverse, climatically and culturally, as most continents. My pilgrimage—which I made sometimes alone and sometimes with my wife—took me 10,000 miles over land and water, from the mountains and hot plains of the north to the deserts and salt pans of the west, from the rocky plateau of central India to the jungles and inland waterways of the south. There, in tiny villages, ancient towns, open deserts, and city slums, I found a way of building far removed from the day-to-day practice of an architect's office—building as it is done by ordinary people.

More than nine-tenths of all the buildings in the world are designed and built like the Kurumbas' schoolhouse, made of mud and thatch and bamboo by the families who own and use them. Villagers throughout Asia, Africa, South America, and Oceania, and in scattered parts of North America and Europe, still build the way they have for centuries, even millennia. Until the last two or three hundred years, the rest of us, who are now capable of building only by hiring trained architects, engineers, and contractors, made our homes in much the same way. Around the globe and throughout the 5,000 years of recorded history, vernacular has been the norm.

Westerners tend to overlook the everyday architecture of India and other developing countries in favor of the celebrated palaces, temples, and mosques that are seen as both more exotic and more civilized. Compared with the grandeur of the Taj Mahal (which is in fact a huge mausoleum), a building like the Kurumbas' schoolhouse is usually regarded as a picturesque throwback. And if the Western eye finds it beautiful, it serves only to confirm Rousseau's image of the state of grace occupied by primitive people before civilization brought their downfall.



Using only the tool he is holding, this Kurumba builder transformed jungle vegetation into a schoolhouse for the tribe's children. The job took barely three days.

But the story is not so simple. These houses are not a breed apart from our own, an intuitive response to shelter by unsophisticated peoples. Rather, they are the work of designers with a keen knowledge of materials and construction techniques. Without exception, the buildings I found were superbly adapted to the climate and the needs of the people who built them. These humble homes are the real, yet unrecognized, splendor of India's architecture. From them, I began to rediscover what the act of building is all about.

A Desert Citadel

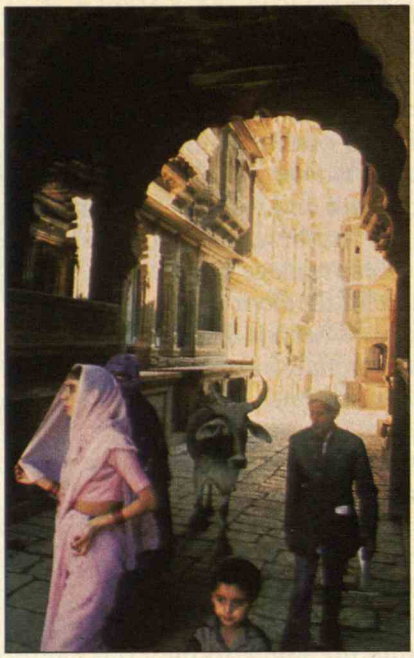
Twelve hundred miles from the jungles of the Nilgiris lie the deserts of Rajasthan, a region with a terrain, a culture, and a way of life so different from the Kurumbas' that it seems scarcely to belong to the same country. As I passed through Rajasthan, this time traveling alone, I came across another superb example of adaptation to an inhospitable environment: the stone houses of Jaisalmer.

When you approach Jaisalmer from a distance, peering at it through the dust and haze of the Thar desert, you are likely to think it a mirage. Jaisalmer is an ancient walled town, overlooked by a gigantic fort, sitting virtually alone amid hundreds of square miles of hard, packed sand and scrub brush. It is one of the world's most curious architectural landmarks, an oasis of urbanism in an environment better suited to camels and desert foxes. In centuries past, the silk route from Mecca to Peking passed this way, and the clever merchants of Jaisalmer drew their prosperity and stylistic influence from the traders who passed through. Over the years, as empires expanded and receded, the trade routes shifted, and today Jaisalmer finds itself isolated, remote, a remnant of the past. Yet despite being consigned to anonymity by the vicissitudes of history, Jaisalmer remains the most important town in the region, the trading center for the hundreds of tiny villages that dot the desert.

That anyone can survive in this brutally hot, dry climate, much less prosper here, seems miraculous. During the summer, when the daytime temperature hovers around 110°F and peaks at 120°, a leisurely stroll in the sun means risking heat exhaustion and dehydration. Even in the winter, when I visited, the air was so dry that three or four gallons of water a day failed to satisfy my thirst. To reach groundwater you have to bore a hole 150 feet deep. If you are lucky and your well produces enough water for a bath or a shower, you can bathe in your clothes and be perfectly dry in five minutes.

What kind of human-made environment offers relief from this assault? When I entered Jaisalmer, passing through a pair of enormous defensive wooden doors pierced with sharp metal spikes, I was struck by the town's extreme density. The streets are narrow and the buildings tall and packed in side by side, not unlike the four- and five-story row houses of New York, Boston, and Philadelphia. Why would people choose to live in such crowding when for dozens of miles in any direction there is only sand?

The reason, of course, is the heat. The less surface a building exposes to the sun, the less material there is to heat up, and the less heat penetrates into the depths of the building. For the same reason, the buildings are long and thin, and with the exception of houses located on the corner of a block, only their narrow front and back

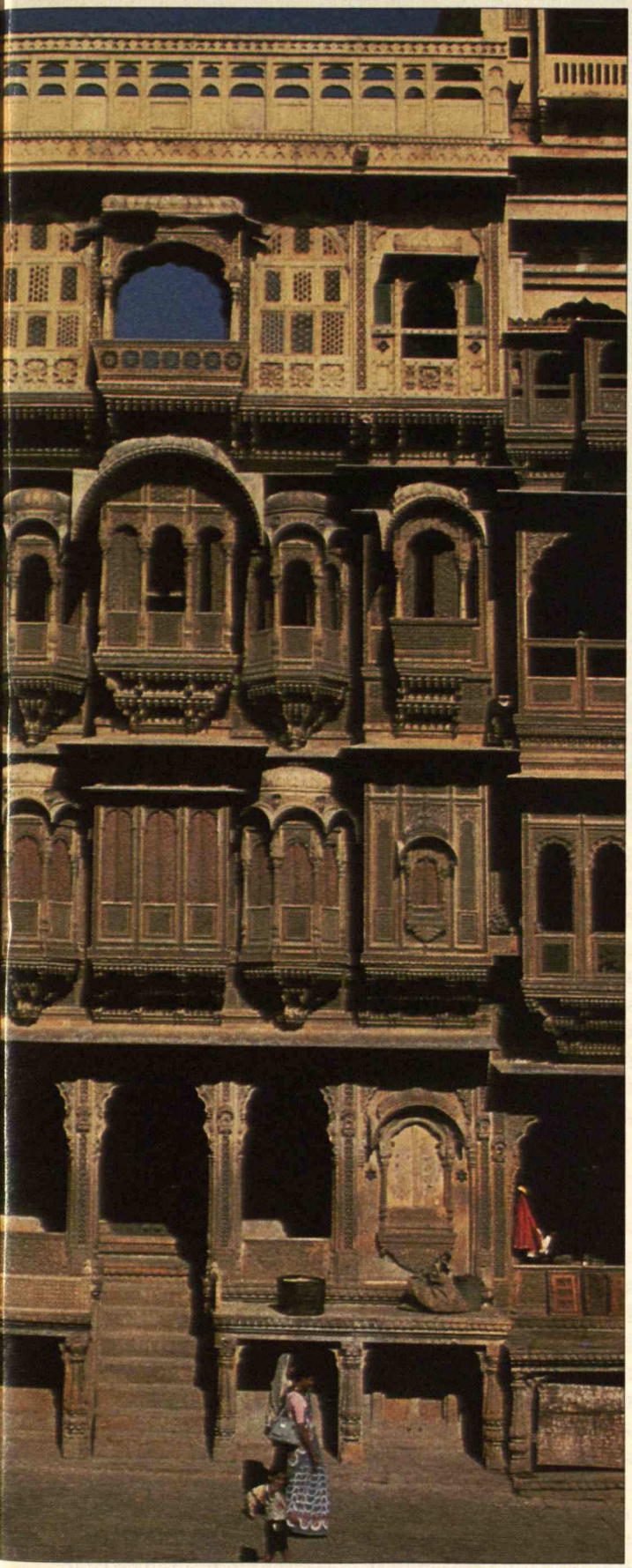








Builders in the town of Jaisalmer have devised myriad ways to beat the desert sun: narrow, shaded streets; façades with overhangs that radiate heat and shade the interior of a stone haveli; *perforated stone windows, or jalis, that block the sun's direct rays (shown in cross section, left); and elaborate cross-ventilation schemes in which hot air exits through courtyards with shafts leading to the roof (above).*



façades are exposed to the street. The combination of tall buildings and narrow streets is crucial for shading the pavement. In Jaisalmer, where street markets bustle with tinsmiths, sari sellers, goatherds, and camel-cart drivers, pedestrians and vendors feel the direct rays of the sun for as little as an hour or two a day.

Jaisalmer's stone houses add to its success in coping with the heat. These *havelis*, common to many parts of north and west India, reach a pinnacle of beauty and sophistication in Jaisalmer. Here they are made from an abundant yellow stone known as *kota*, which is strong enough to form cantilevered balconies that project three feet and fine-grained enough to be minutely carved without falling apart. The craftspeople who built the *havelis* used a system of modular construction, cutting the *kota* stone into standardized columns, beams, wall panels, and floor slabs that could be arranged in endless permutations to give each house both a unique character and kinship with its neighbors.

Kota is ideal for the climate. Like most stone, it is a good insulator or, put another way, a poor conductor. It reflects most of the sunlight that strikes it, heats up slowly, and allows little of that heat to pass through, exceeding concrete in all three properties. At night, when the temperature sometimes drops precipitously, the stone radiates the heat it stored during the day. The flat stone roof of a *haveli* makes an ideal surface for sleeping, as residents can gaze up at the most amazing starlit sky I have ever seen, a deep blue dome with a million lights, and enjoy the cool breeze with the memory of the day's sun warming their backs.

The *haveli* builders have brought cross-ventilation to its peak of sophistication. A good portion of the sun-facing wall and roof areas is covered by a protective outer layer, such as an overhang, a projecting balcony, or a window with an arched recess, that takes the brunt of the sun's rays and helps draw cool air from the shaded street into the building. This cooler air circulates through the rooms (there are few interior walls to block the flow), replacing hotter air that exits through one of the two or three internal courtyards.

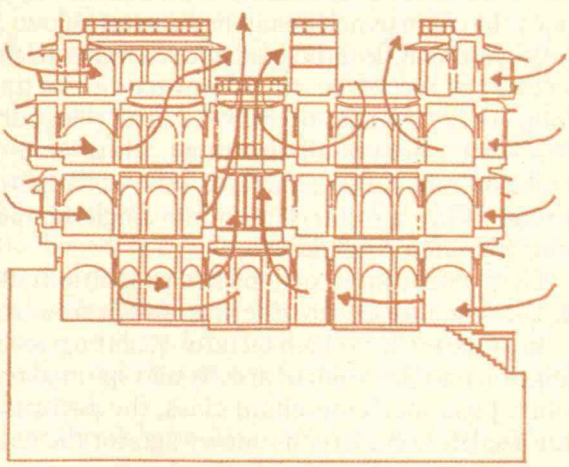
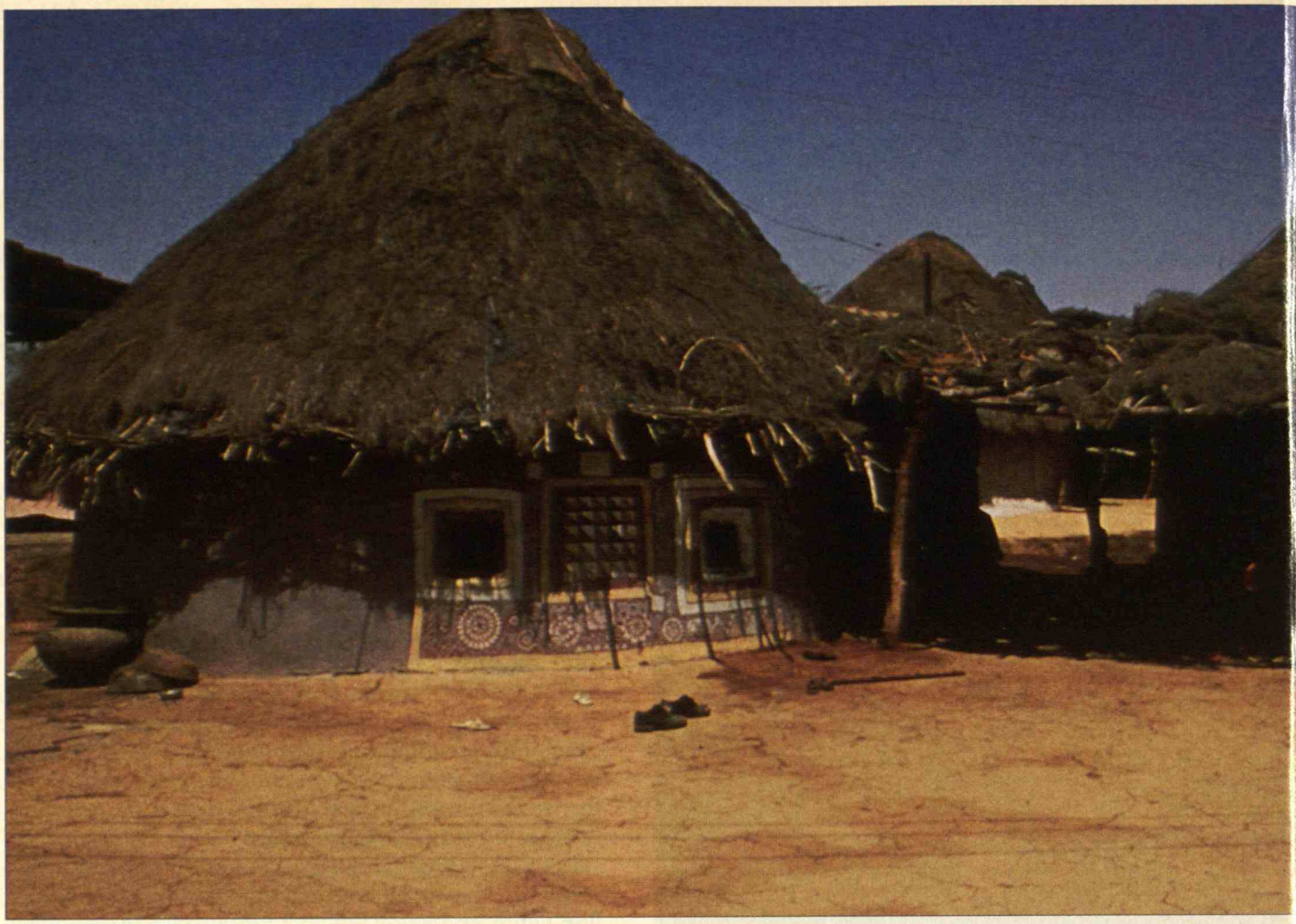


ILLUSTRATION: BASED ON A DRAWING BY KLAUS HERDEG



Another aid to comfort is the intricately carved stone grille, or *jali*: a window with many small openings, some so tiny you can barely fit a finger through. Its downward-sloping holes block the direct rays of the sun while permitting air to enter the room freely. *Jali*s are also ingeniously designed to grant privacy, an important commodity in a society that is densely packed and where women traditionally have been kept from public view. Balconies on opposite sides of a street in Jaisalmer are often so close that two neighbors could reach out and shake hands. But the *jali*, with its sloping holes, lets *haveli* dwellers avoid seeing each other even as they enjoy the comings and goings in the street below.

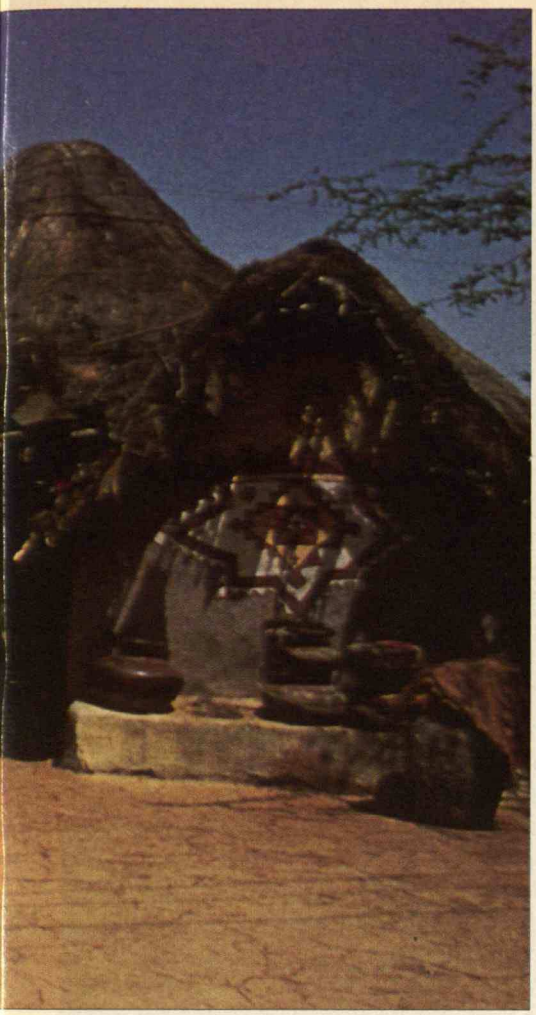
Because so little direct sunlight penetrates to the deep recesses of the *haveli*, the rooms tend to be dark. To compensate, mosaics of mirrored glass tiles, curved so they scatter light in all directions, adorn many of the walls. In some homes, mirrored spheres hang from the ceiling. When a room is lit up by a single candle or oil lamp, the effect is magical.

The spatial complexity, the fine proportions, the subtle carving, the delicate filtering of light from room to room—these elusive architectural qualities pass beyond function into the realm of artistry and spirituality. Sadly, when Jaisalmer's merchant class, the patrons of the *haveli*s, left home over a century ago for the new business centers of Bombay, Calcutta, and Madras, the indigenous building trade slowly expired. With it went much of the city's appreciation for the spiritual qualities of architecture, and today in Jaisalmer it is possible to see half-constructed concrete buildings with protruding steel bars. But farther south, in the Great Rann of Kutch, Cheryl and I discovered an ancient building tradition that still thrives.

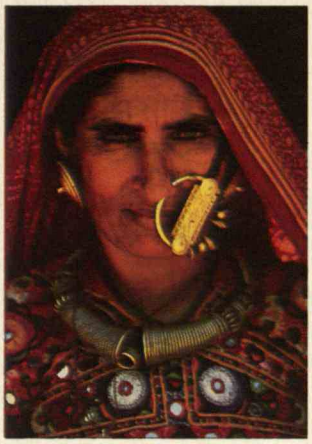
A House of Mud

It would be hard to find a more inhospitable environment than the Rann (*rann* means desert; Kutch is a region bordering the Arabian Sea). For half the year, the region contains barely enough water to sustain its population of wild asses. The flat expanse is broken intermittently by hardy *khezri* trees and scrub brush, but these are so rare that some species of birds make their nests out of soil. We drove into the Rann in this dry season, a time when cyclones gather on the horizon, whip up the sand, and send it flying onto your face and skin.

During the other half of the year, the Rann becomes a vast saltwater swamp. The monsoon rain that falls in the mountains to the north and west runs off into the Rann's sandy soil, where it refuses to drain. The scat-







A village home in West India's Great Rann of Kutch is built from the simplest materials—mud, dung, tree branches, and grasses—yet provides shelter from high winds and a wildly varying climate. The ornate decor harmonizes with the fashion sense of the occupant.

tered villages are carefully situated on small hillocks, the highest ground for miles around, so that their 20 or 30 houses will not be submerged by the rising seawater when the monsoon comes. During the rains, some villages turn into islands. We visited a half-dozen villages, of which one of the most beautiful was Ludia.

The men of Ludia dress in white cotton robes and loosely wrapped pink and blue turbans, clothing ideal for keeping out the sun and allowing air to circulate and cool their bodies. Their camel-leather shoes have curved, pointed tips that glide over the the sand. The women, dressed in brilliantly colored gowns adorned with sequins, stitched-in mirrors, and coins that dangle from little chains, wear a dozen white carved-bone bracelets on each arm. One woman we met wore a nose ring so heavy that she had tied it back with a braid of her hair. Speaking through our guide, Dinesh, we asked her to tell us about the construction of her house, which she had helped design and decorate. She was happy to oblige.

A house in the Rann consists of two or three *bhunga*s, or round huts, along with a couple of smaller, square buildings called *choki*s. Each building is a single room; imagine a Western house where the living room, dining room, kitchen, bathrooms, bedrooms, attic, and basement were somehow dismantled and laid side by side. In this woman's house, the *bhunga*s and *choki*s were connected by low mud walls and shared a mud platform. The platform lifted the entire house above flood level, kept out snakes, and demarcated the family's plot. A spindly wooden trellis with a woven top provided the outdoor area with shade.

Each of our host's *bhunga*s was a perfect union of form and function. From the outside, its most striking feature was the huge, conical roof made of branches and matted grass, woven tightly to keep out the dust and sand storms. Supporting the roof was a circular wall that came up to eye level. This wall, extremely thick and made of hardened mud, was emblazoned with geometric designs in earth colors of pink, yellow, ochre, and gray.

To make such walls, the woman explained, mud and dung are mixed with water and straw; the straw, we realized, adds tensile strength the way steel bars reinforce concrete. The mixture is then shaped into blocks and dried in the sun. Once dry, the blocks are stacked in the shape of a ring and mortared with a wet paste of mud and dung. Curving the wall enables it to withstand high winds and exposes less surface area to the sun. ("The igloo of the desert," Dinesh offered.) When the wall is complete, its exterior surface is whitewashed with a water- and insect-resistant coating of lime and then decorated.

Ducking through the diminutive doorway, I found the

interior cool and well lit. The roof was cleverly designed. A single huge beam of wood, one end of it retaining the forked shape of the original tree, spanned the room, leaving just enough headway to pass beneath it. A wooden strut transferred the weight from the peak of the roof to the center of the beam. It was a minimal structure, a design at once attractive, elegant, and efficient.

Although the diameter of the room was so tiny that two people with arms outstretched could have touched opposite sides of the wall, the high ceiling, low windows, and sparse furniture created a feeling of openness. The high ceiling has another function, to draw hot air upward through tiny gaps in the branches and dried grass. The cool air settles at floor level, where people can comfortably sit and sleep.

The most extraordinary feature of all was the exquisite bas-relief on the inside wall. Its geometric designs and stylized trees, flowers, people, and desert animals (including a scorpion, a sparrow, and a peacock) had been made from a paste of mud and dung. The sculptures were both eye-pleasing and functional, for they formed built-in cupboards that held our host's pots, bottles, and utensils. At a time when so much of Western architecture is preoccupied with expensive, glossy materials like marble and high-polymer plastic, I was reassured to find that there is beauty still to be made from the droppings of the wild ass of Kutch.

Living on a Fault Line

In topography and climate, the mountainous region of Kashmir could not be more different from the Rann of Kutch. To reach the capital city of Srinagar, Cheryl and I endured a 12-hour bus ride of winding roads and hairpin turns. The snow-capped Himalayas were almost stunning enough to distract us from the alternative view—watching the outer wheels of the bus slide off the road and hang out over the edge, spinning against air. Eventually the last of the mountain passes was behind us and the city came into view.

The scene that greeted us encompassed a spectacular green valley, two crystalline lakes, and a Prussian blue river, the Jhelum, snaking down the hillside and passing through the center of the city. Along the riverbanks, three- and four-story houses huddled side by side like gossiping neighbors. Their cohesive appearance speaks of a collective battle against the forces of nature, reflecting a tightly knit society that has evolved almost in isolation over 400 years. So closely packed that they seem almost woven together, with wooden balconies and steeply sloping roofs (now mostly of corrugated metal but formerly of packed earth), the houses form a subtle tapestry of gray stone, auburn timber, and terracotta brick.

And yet the picturesqueness of the buildings of Kashmir belies their secret strength. As if the subzero temperatures and frequent blizzards of a nearly six-month winter were not enough, Kashmir lies in a fault zone. The woven appearance of Kashmiri houses disguises an ingenious structure capable of withstanding a major earthquake.

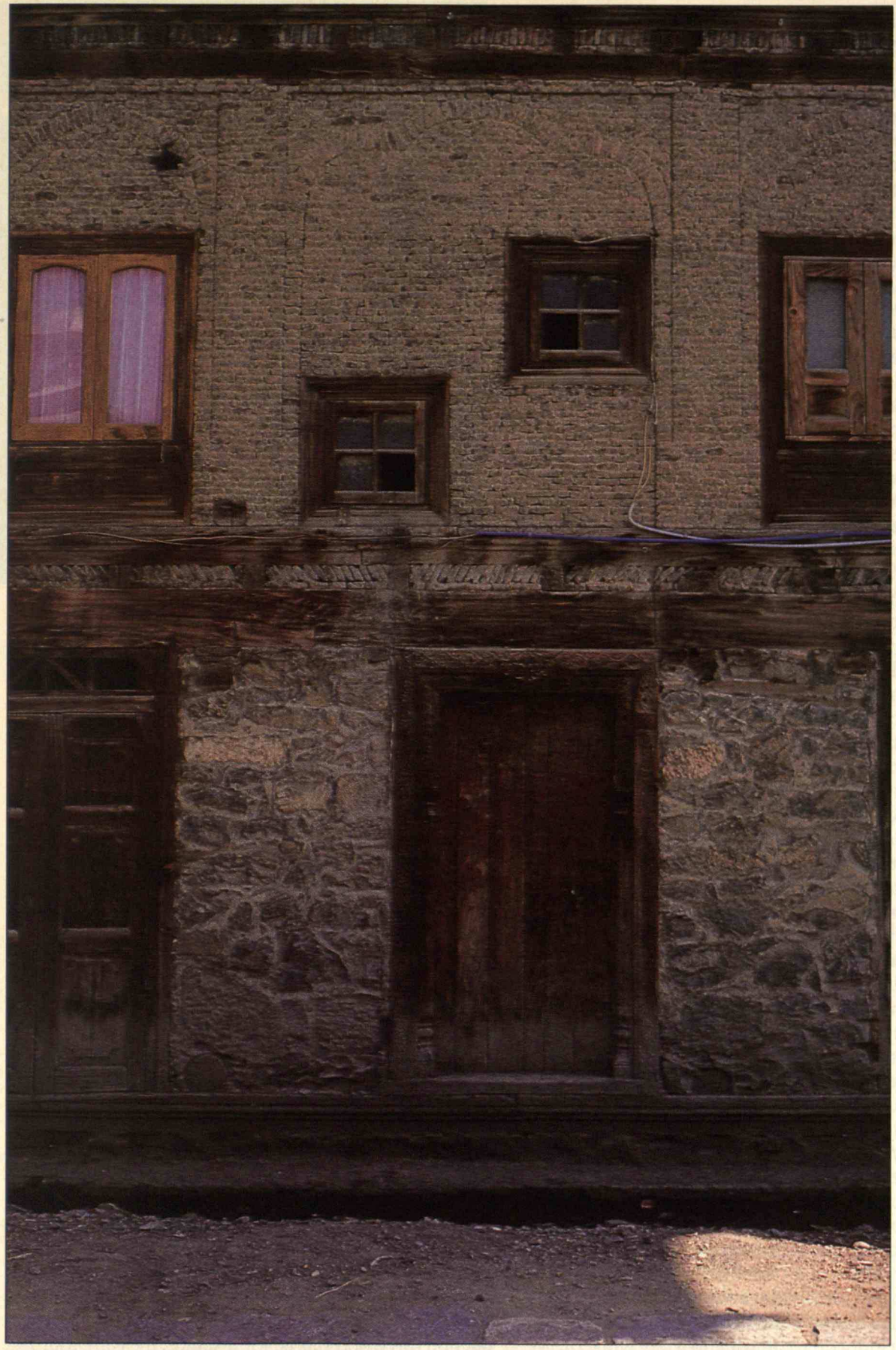
If the Kashmiris lived on a fault line in the tropics, their houses would probably resemble the flexible frame huts of the Kurumbas. Because of the cold, the Kashmiris have no recourse but to make their walls out of heavy, insulating masonry, which would ordinarily buckle or shear apart in an earthquake. Their solution is a system of construction called *taq*.

The *taq* system employs three innovations. The first is a frame that skillfully interweaves the building's main structural components—the wooden beams, the brick walls, and the brick or stone piers—so that no one part is left to fend for itself against the powerful kick of an earthquake. The second innovation concerns the thinness of the walls. Because most of the building's weight is borne by the massive piers, the walls can be as thin as the width of a single brick or a pane of glass, as in modern "curtain-wall" construction. (In contrast, walls that bear the weight of the stories above them must be at least one or two brick-*lengths* thick.) But unlike curtain-wall construction, the *taq* method permits each wall panel to bear just enough load to pass some of the force of an earthquake to the wall panels directly above and below. Each panel acts like a car bumper, absorbing the impact and damping the energy of a collision.

The third innovation is in the mortaring of the bricks. When an ordinary brick curtain wall is hit by an earthquake, it tends to concentrate the force along the diagonal of the wall, which shears in two. A *taq* wall is more flexible because the mortar between the bricks is weak. The architectural historian Randolph Langenbach speculates that in an earthquake, the individual bonds between the bricks are severed and the force is dispersed. The piers lean, the floors tilt, the walls shift, the mortar cracks—but the building is left standing. After a quick repair, it is back in shape and ready for the next earthquake.

A Sense of Rightness

There is much for a Westerner to admire in the technological virtuosity of *taq* construction, the mud *bhunga*s, the stone *havel*is, and the Kurumbas' bamboo-and-thatch schoolhouse. The knowledge they embody is the product of centuries of work by people who experimented, adapted, transformed, and then passed along their successes and failures by word of mouth. Yet the beauty, strength, and sophistication of Indian homes results not just from a way of building but from a way of life. To grasp the more important lessons these structures have to offer, one must delve beyond mere technological virtuosity to the essence of vernacular building itself.



To withstand frequent earthquakes, buildings in the Kashmir capital of Srinagar consist of interwoven layers of timber and masonry that dissipate seismic forces. Brick arches, faintly visible above the windows, take a load off the thin walls and transfer it to sturdy masonry piers.

Despite their diversity, the dwellings I encountered on my journey, of which the ones presented here are just a small sample, have one thing in common. They all embody a sense of spiritual and aesthetic "rightness"—a sense that they belong to their environment, their culture, their corner of the world. At the risk of being too tidy, I submit that the rightness in vernacular architecture springs from a combination of five qualities:

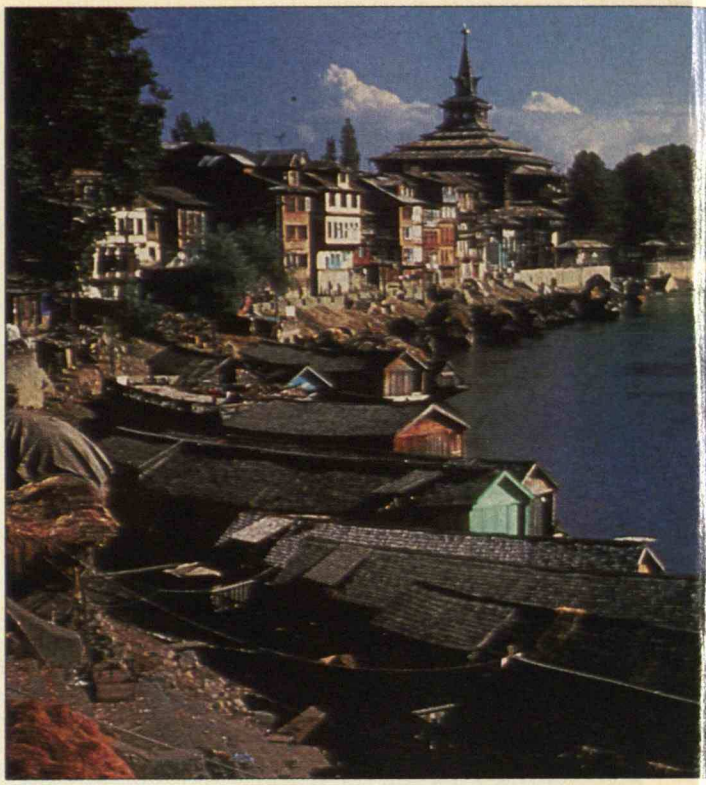
Honest use of natural materials. Vernacular building employs stone, brick, wood, thatch, bamboo, mud, and other materials in a way that makes best use of their inherent properties: their ability to take a compressive or a tensile force, to be molded and applied by hand, to provide insulation, and to resist fire, insects, or rain. These materials are used honestly, without artifice. They each possess an unadorned natural beauty, a unique range of color and textures, and with few exceptions do not need to be dressed up: they speak for themselves. When adornment is used, like the earth pigments applied to the sides of a *bhunga*, it is clearly decoration and not decoration masquerading as function.

Design and construction by the occupants. When families design and build their own homes, alone or with the help of local craftspeople, they experience the joy of shaping their own future. The houses they make reflect their culture, climate, origins, and values, lending a distinct character to each region and often each village. The result is consistency without dullness and unity within diversity, and the family is woven into the community and its natural surroundings.

In contrast, home building in the West has been surrendered to architects, technical consultants, parts manufacturers, contractors, subcontractors, and bankers. Instead of the three days it took to build the Kurumbas' schoolhouse, the ordeal may take two to three years—and the owners and occupants vanish in the process.

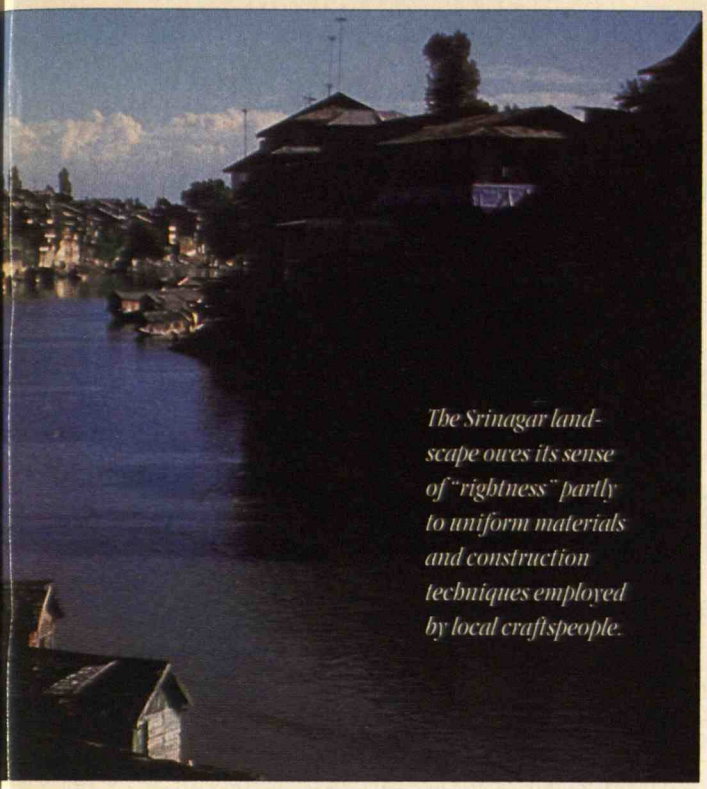
The more the responsibility for design and construction is placed in the hands of a small, specialized group, the less likely buildings are to reflect the will and desire of their owners or the particularities of their region. Of course, there are exceptions: sympathetic architects and contractors working with responsive, and responsible, clients. But the pattern is all around for us to see. The Western landscape is becoming homogenized.

Economy of means. When poor people build a house, the process has to be efficient. Materials must be inexpensive or free, labor no more than what is essential. In most cases, houses are built incrementally, with a new wall or roof added only when the owner can afford the time and cost. Mahatma Gandhi maintained that the ideal house in the ideal village would be constructed only of materials found within a five-mile radius, about the distance an individual can walk in a day while carrying a heavy load. Of necessity, many village houses in India meet that standard.



Why should frugality be an architectural virtue? Because it requires that form and function not be subservient to style. In the vernacular architecture of a given region, the layout of rooms or the pattern of woven thatch may vary, but the method of construction and choice of materials will be similar. Buildings in the West, meanwhile, often struggle to differentiate themselves from one another with functionless columns, arches that bear no load, and other frills—all constructed at great expense—that add up not to harmonious diversity but to a disquieting jumble. This phenomenon is now occurring even in India: in Ahmedabad, a city of extraordinary brick arches, vaulted ceilings, and domes, it nearly broke my heart to see builders putting up a shop façade with veneer plywood arches.

Regard for human scale. This quality arises as an inevitable consequence of using natural materials honestly and economically. The proportions of most village houses are based on the human form or on the sizes and strengths of the materials at hand: how wide a person can reach with arms outstretched, how far a beam made from the trunk of a tree will span, how great a load can be borne by an arch made of sun-dried brick, how low a roof eave must hang to keep out the sun and rain. In contrast, industrialized construction is often based on arbitrary units like the meter or on a repeating module that happens to be an efficient size for commercial production (plywood sheets, for instance, measure four feet



The Srinagar landscape owes its sense of "rightness" partly to uniform materials and construction techniques employed by local craftspeople.

by eight feet). In industrialized architecture, man is no longer the measure of all things.

The limited span of natural materials and the fact that they must be carried and lifted in place by hand actually improve the design, forcing builders to solve problems imaginatively. To build a three-foot cantilevered balcony for their *havelis*, the masons of Jaisalmer had to devise a system of interlocking stone projections. When industrialized designers can easily span 30 or 40 feet with a reinforced-concrete beam and 100 feet with a steel truss, it is unlikely that the same task would spur them to acts of great invention. In fact, why bother carving a stone *jali* for ventilation when you can simply install an air conditioner?

As a result of such technological advances, our buildings often diminish the human beings they are designed for. The characteristic modern office building, reflecting a compulsive drive to maximize floor space, allows office workers to sit in windowless boxes where they become oblivious to the rhythms of nature. Although many people now take this absurd situation for granted, it became possible only with innovations of the last hundred years: the steel building frame, mechanical air circulation, and the elevator. The constraints of vernacular architecture provide a safeguard against such anonymity and loss of human scale.

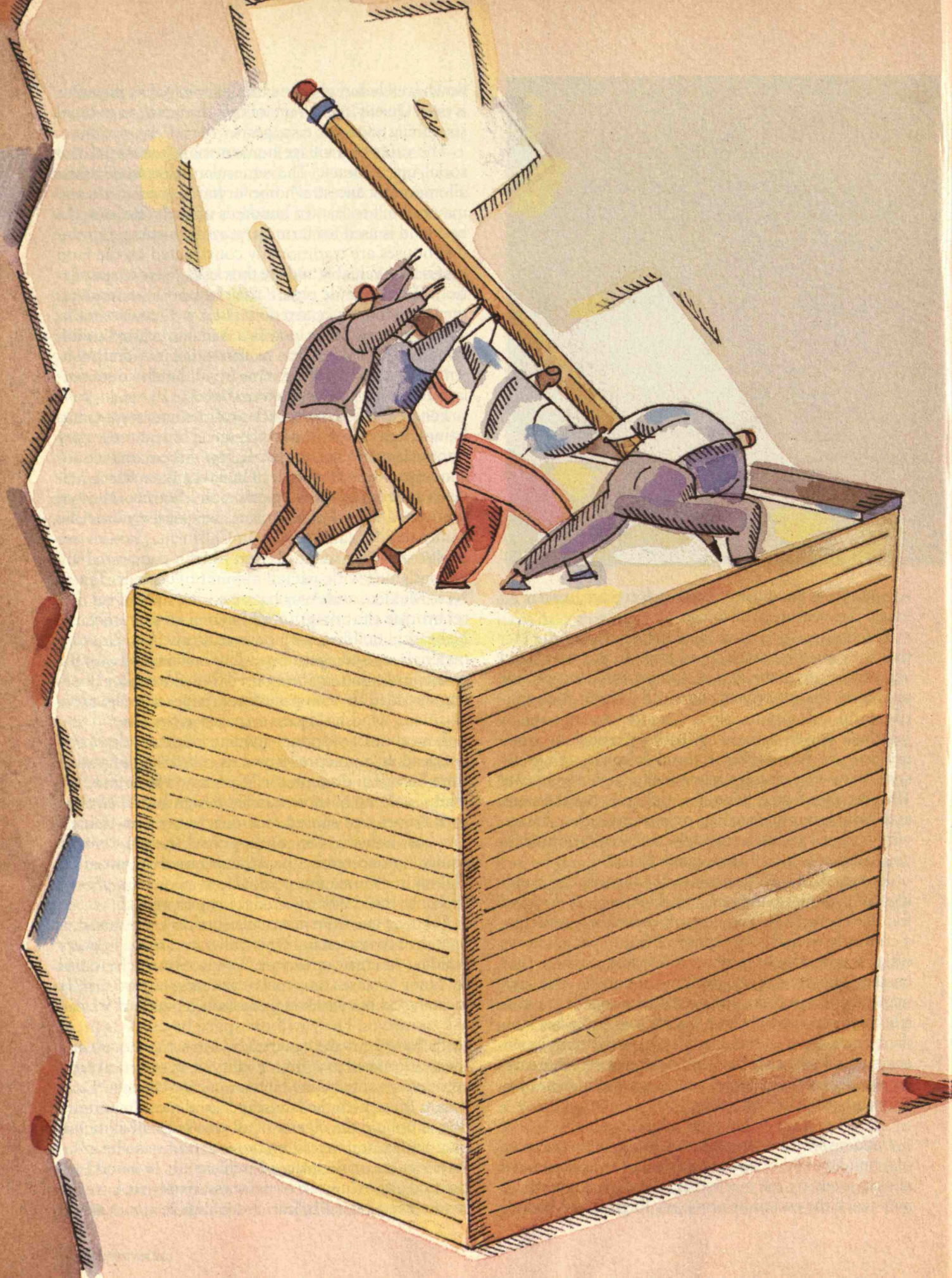
Building for future generations. In the West, the value of a building and of the land it sits upon is determined almost solely by the marketplace. As a result, a house may reach the end of its economic lifetime and be torn down well before the structural lifetime of its materials is over. Quietly, almost unnoticed, the incentive to build something of quality disappears.

The value of a village home is mainly spiritual and social, not economic. The vernacular house serves as the all-important ancestral home for future generations and may be built to last for hundreds of years. Because the best land is used for farming, grazing, logging, or mining, houses are traditionally constructed on the land that is least valuable and are thus less subject to speculation. When people regard their house as permanent, they have more incentive to build it well, to care for it, and to preserve it. So long as it remains in good condition, there will never be a reason to sell it or destroy it. And so, paradoxically, the mud and thatch house outlasts the building of concrete and steel.

For most Westerners, such qualities may seem tantalizingly out of reach, and the sense of rightness they impart lost forever. After all, few Americans would choose to live as the people of India do. But nothing prevents us from borrowing principles like economy of means and the use of abundant, inexpensive materials. Many builders already do. In California, houses are being made from rammed earth—highly compacted soil strengthened with a small amount of cement. Texas, New Mexico, and Arizona are seeing the revival of a technique that originated in turn-of-the-century Nebraska: building with bales of straw. And recycled materials are finding their way into buildings all over the country: old tires are being used to make rubber flooring, shredded and compacted newspaper to make office partitions, windshield glass to make kitchen tile.

Even control over one's own architectural destiny is not dead. In a practice known as cohousing, imported from Europe and adopted in Washington State and elsewhere, a dozen or more families design and build their own homes and shared facilities. In my own field of low-cost housing, the concept of self-help or "sweat equity," pioneered by the Atlanta-based organization Habitat for Humanity, permits low-income families to exchange their labor for a reduced mortgage.

Taking a cue from vernacular builders, we can train ourselves to search for practicality and value in every building we create or occupy. We can refuse to be fooled by fancy fixtures, expensive veneers, or potentially meaningless figures like square footage. Instead, we can ask ourselves, How will the space be used? Is more really better? Are the materials and structure honest and the workmanship of high quality? Does natural light enter every room? Is the building energy-efficient? Does it harmonize with the landscape? And most important, does it uphold the dignity of all who enter it? By shunning artifice and excess, everyone can exert some influence over the marketplace of architecture. In the end, we can find our own sense of rightness, if only we have the wisdom and the will to learn from humble homes. ■



Collaboration in the Electronic Classroom

By Edward Barrett

Mention computers in education and people picture a room full of video display terminals where students go to crunch numbers, do word processing, or review foreign language exercises. Many faculty and administrators fear some monolithic "teaching machine" that programs students to learn in rigid, algorithmic fashion. Or they imagine forms of artificial intelligence that think *for* students rather than with them.

And not without reason. Until recently, most educational software marched students through a set of steps supposedly equivalent to the cognitive states "experts" possess at different stages of completing a project (or indeed, of personal development). To make matters worse, computer labs were usually classroom add-ons, places where students were sent for self-paced tutorial work. There they could trace and retrace programmed learning loops—sometimes containing subloops to give the appearance of intellectual searching—until they presumably internalized the promptings of the machine.

Computers can help students learn by improving their ability to give and receive criticism—but only if educators know how to implement the technology.

But my colleagues and I in MIT's Program in Writing and Humanistic Studies felt strongly that this was not education. We didn't want to use computers to simulate a fictive expert; we wanted the technology to support the complex private and social activities that make up the learning process. With that in mind, we developed the first university classroom that relies on a "fully distributed computing environment"—that is, a computer network that allows each student access to software, personal files, and communications utilities such as electronic mail, all of which are stored on server machines scattered around campus. This network—along with specially designed software and a classroom layout more conducive to discussions than lectures—facilitates a web of interactions. Thus computers do not replace teaching but help students relate to faculty, online information, and one another. Aspects of our approach are catching on, too. In the six years since we developed our electronic classroom software,

ILLUSTRATIONS: ROBIN JAREAUX

it has been put to use in 20 different courses across the MIT curriculum. Most U.S. colleges and universities have begun to develop versions of online classrooms, and it would be hard to find a major university that does not have one now. The majority are contained within one or several buildings, but some have much more extensive online environments or are planning them.

To our way of thinking, an electronic classroom is a "virtual" space that exists not only within four walls during scheduled class time but also outside those limits, to be invoked anytime, anywhere, by any class member, to suit his or her educational needs. In essence, such a classroom is always in session. It's a social construct—a communications matrix supported by computational technology, not constrained by it. In other words, we've taken the notion of a society of mind and turned it inside out, shifting focus from how thinking might proceed through certain standardized stages to how the processes of investigating, positing, arguing, and reviewing occur in a diverse community. Instead of fixating on how to model the mind in a machine, we've paid attention to the social content of the classroom and the surrounding milieu. We've found that a fully distributed computing environment can support unlimited communication of insights and foster recombinations of information that lead to new ways of looking at all kinds of subjects.

The computer, in short, can become a tool students use to synthesize their own ideas. And a writing class is the ideal place to experiment with such a system, since writing is by nature a synthesizing activity. Writing is in fact thinking: it allows students to explore what they know and how they know it.

Computers as Meeting Places

At the core of our work in writing instruction is NEOS (Networked Educational Online System)—software that never attempts to dictate a process of investigation or an end to that investigation. Instead, it supports the activities that, we feel, define education in any subject area. These activities include the study of curricular materials, the creation of texts—which can mean an essay or a math problem, a poem or a program code—and the review of such texts by instructors. And these activities also extend to a continuous exchange of texts and commentary among students and instructors alike. What's more, NEOS allows all of this to go on both in and out of class, in a manner that closely approximates the collaborative give and take of the professional world.

When students or instructors log on to NEOS, they are presented with a simple editing window. Above that window are various icons they may click on to perform a range of operations. They may choose "turnin" to share work for comment, or "pickup" to see what comments have been made on work they turned in earlier. An "exchange" button allows students to distribute and comment on one another's work independent of the instructor in smaller peer groups. Students may click on another icon to call up an online textbook, while a "handout" button gives them access to the rest of the online curricular materials. A "help" button calls up information about the software for the neophyte user.

NEOS also supports an "annotation facility," which provides the online equivalent of post-it notes—scrollable pop-up windows the instructor and student colleagues can place anywhere in a text to write comments of any length. Each window is identified by the commentator's name so students may inquire of that person further, if they wish. And no matter how numerous or detailed the remarks in these windows become, there's rarely a sense that they're overwhelming the text: what students get back are not papers covered with red marks but clearly legible comments nested within the text. Commentators may leave these windows "open" or close them, leaving behind a small icon of a page that a student may click on to read comments.

In contrast to the conventional classroom with its podium stage, a classroom that relies on NEOS works most effectively when it features no visual clues to suggest that the instructor is predominant in discussions. Our experience suggests that the best idea is to have a central seminar table at which students may engage in face-to-face conversation. They should be able to turn from this table to their computers, which ring the periphery of the room. The instructor's workstation is integrated seamlessly into this ring.

The classes themselves, in fact, are defined by the needs of the students. We may begin by considering several pieces of writing that students have recently turned in, viewing these texts both at our individual workstations and on a large-screen projection. The pieces may have been commented on by the instructor alone, by the instructor and a small group of students, or by the whole class. After seeing the effects of suggested changes by manipulating the text on the large-screen display, my students might turn to their computers to experiment with one or more rhetorical strategies. I may ask them to pick up a sample text from online handouts, focus on one or more student essays, or create something new on the spot. Outside of class they continue to review, discuss, and re-create their ideas with help from both the instructor and one another. Thus the computer becomes a vehicle for sharing work—the difficult process of studying texts for meaning, imagining different ways of thinking, communicating those ideas to others for review, and then embarking on whatever new cycle that review suggests.

In my upper-level course in engineering and scientific

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writing, for example, one of the hardest lessons to convey is how to write a clear statement of the problem an experiment or design or program is supposed to address. I usually begin by asking students to spend about 20 minutes revising stray sentences—correcting errors, or, more typically, cutting out deadwood for greater conciseness or changing syntax to make the author's intended meaning more apparent. Students start to see that good prose style is as important to a text as a well-designed arch is to an overpass. Some structures work; others don't.

We also dissect statements of problems in published technical papers; sometimes I will have altered the original and I'll ask students to revise it for greater clarity. They turn to their screens and work at this task, then "hand in" their revisions for discussion on the big screen. Next they go back to their screens and attempt a statement of the problem their own research might focus on, again handing these in for discussion by the whole class. During that discussion we usually rewrite portions of a student's text so that everyone can see once more how revisions affect overall meaning. Outside of class, I comment on students' statements online and return them over the network. They can use such texts as a starting place for the proposal they must write for the class or as an early draft for the introduction to their final report. They also have complete online access to the original examples to use as templates.



The electronic classroom is a "virtual" space that can be invoked any time, anywhere, by any class member.

One key teaching strategy is to ask small groups of students to exchange their drafts online outside of class. Although I rarely check this exchange, I generally have a set of questions students must pose to one another (Is the real-world problem clearly and concisely stated? What are the related technical issues? What's the actual point of the experiment?). I may also ask students to sum up their reviews of one another in a brief memo that they must e-mail to me—a sort of role-playing activity wherein I play manager and they supervisors of engineering staff.

Through this exchange, students in effect become instructors: they are active agents in changing another's writing. And they quickly learn that their critical language is woefully inadequate—on the first round, they produce a lot of "nice sentence/awkward sentence" comments, and then, seeing how little these help, they begin to develop a more professional approach. "Do less of this," they'll say; or "The problem as I see it is to develop this paragraph more fully"; or "What if you try switching the order of these two sections?" The assignments are less like homework and more like the actual interchange of ideas that occurs in the workplace, whether industrial, governmental, or academic.

I conduct the same kind of exercises in my class in reading and writing the essay, where we focus on making sense of various texts, personal experience, or the experiences of others. The cycle of in-class work, coupled with out-of-class reviews from peers and the instructor, pushes students out of some fairly hoary five-paragraph college-board essay styles into real textual savvy. We are able to isolate an essay's main arguments and assess their effectiveness right before our eyes. It is easy to show where an essay has trailed off into abstractions, pieties, or clichés. We can applaud what works, and we can experiment in real class time with different rhetorical strategies to revise those passages that don't move the meaning of the essay forward.

Students thus develop a greater awareness of audience and personal voice. They see what others in the class are up to, and writing becomes more a dialogue within a community than an abstract, required act. Indeed, it is this sense of sharing that makes our conception of the electronic classroom appeal to other classes in the schools of engineering and science. In a programming class, NEOS allows code to be written and then turned in, compiled, tested, and annotated more easily. In engineering subjects, it allows more collaboration on technical reports or proposals. Students see how their input affects another's performance—surely an important lesson for nascent engineers and scientists whose professional development is so closely tied to peer review and communal thinking.

Less Pain, More Gain

In some ways, we are only beginning to understand the effects of the electronic classroom. For instance, students sometimes seem to prefer the old-fashioned red marks of hardcopy grading to the pop-up windows of the online annotation facility. But my experience suggests that this is because it's less work—red marks give students a quick take on the reactions to their writing while pop-up windows, each of which must be opened, read, and digested in turn, make assimilating commentary an intellectual exercise in its own right. After seeing an essay returned with lots of red marks stuck in the margins or between the lines, more than one student has come up to me to apologize for not doing well. I've surprised these students by telling them the comments were generally favorable—I was tuned in to their essay and responded to it out of enthusiasm. They obviously had not read my remarks; they assumed an inverse ratio between the number of marginal comments and how high a grade they would receive.

The online annotation facility makes the teacher work harder, too. I can no longer get by with a hastily scribbled "awk" in a margin and a squiggly line underscoring a phrase when what's really wrong is that a passage is poorly thought-out. With pop-up windows, the space limitations that make one- or two-word comments seem sufficient disappear. NEOS, in other words, requests of me that I think through my commentary more carefully, with the effect that I make longer remarks and comment more on structural elements. In fact, I may actually transpose paragraphs, or key my comments to online handouts or the online style guide written especially for my course. I am now less a grader than a collaborator, which has the effect not of diminishing my authority but of empowering my students.

Interestingly, this extra work I have to do doesn't seem especially onerous. As an experiment, I print out all the commentary I put on student papers each semester. I am surprised to see that one class of 16 students may result in close to 100 pages of remarks. Yet I am not aware of spending more time on student papers than I did in the conventional classroom. It seems that NEOS allows me to write more on student papers in about the same or even less time.

And even though students may at first be taken aback by the amount of commentary, they rarely complain that online classes eat up more of their time. It may be that when the drafting process is so much a part of the class, students don't spend as much time unproductively floundering around on writing assignments the night before the due date. It may also be that since students use workstations to exchange and review papers, they are able to perform tasks in parallel: in one window a problem set, in another the draft of a technical report. I have always thought computers make me more productive because I can do many things at once—rather than getting up and wandering away when I am bored with one task, I can simply turn to another window and another project.

Anonymous student responses to questionnaires about the electronic classroom suggest that the majority prefer the intellectual questioning such an approach engenders over the single-minded focus on assignments and due dates in conventional teaching. Students like the increased communication among peers, and they come to develop a feel for intellectual discussion. They say the quick feedback loops that NEOS supports help them engage in dialogue so they can get the point of a particular criticism of their writing more easily.

Such dialogue drives them to do more revisions. It has not been unusual for them to turn in an essay, receive my commentary, and resubmit another draft before the original due date. In other words, students concentrate on the process of writing and thinking rather than on the usual pattern of assignment-performance-grade that predominates in much university teaching. Of course, final drafts are due and final grades assigned. But the intellectual effort of arriving at that point is defined by discussion, consensus, and understanding instead of expectation and either disappointment or celebration. The obsession with a grade is replaced by engagement with the process of discovery.

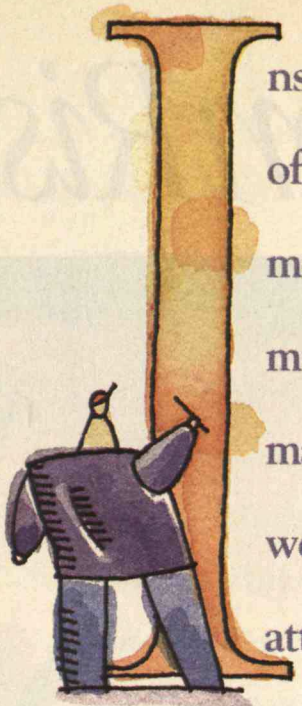
Students also favor the mix of theory and practice in online teaching—the switching from discussion to writing to review in real class time. In surveys, they unanimously say that this is one of the chief benefits of the electronic classroom because it has lasting effects on their writing. The word they repeatedly use to describe the online review cycle is "natural," which seems to indicate that they have come to see writing not as a dead product but as an extension of thinking through a problem.

At the end of a semester in an electronic classroom, students report that they write more, and more effectively, and that their style of writing is closer to their own voice than ever before. This suggests that they are more willing to make the art a part of their professional lives. Many say they want to take another writing course, or even ask me about minoring, sometimes majoring, in writing at MIT.

Toward Seamless Interchange

In terms of our original design goals—to support the social processes of learning—the electronic classroom is a success. NEOS and the online environment encourage greater communication, increasing the use of language to make a point. Theory is integrated with practice in real time so that writing seems less academic, less removed from one's own concerns. Students are less passive in and out of class, less rote learners, more collaborators with the instructor and one another.

But are students really better writers at the end of the semester? I'm convinced that they are. For one thing, research into writing and learning over the past decade has shown that the kind of active, guided collaborative efforts fostered by online teaching result in more mature writing by students, and in some cases higher scores on graded writing samples. Yet numbers alone cannot measure success in writing. On the basis of improvements in my students' writing, I can make certain qualitative comments about the value of the electronic classroom.



Instead of trying to model the mind in a machine, we've paid attention to the social context in which learning occurs.

In my advanced essay class and advanced seminar in scientific and engineering writing, students rarely need remedial work on grammar and syntax, but neither have they developed a distinctive writing style. Over the semester, as they write more drafts and exchange more comments, their willingness to argue in prose—to state a position and defend it—matures. They begin to use language that is simpler yet more expressive of fine points of distinction. Length of essays also increases, not because of wordiness but because of the depth of understanding students reach through the constant questioning of their ideas. It becomes easier for them to think of an essay topic because they have more people asking them about what they're interested in and how they will make their case. And as they write in this engaged way, it becomes more enjoyable to read their work—more a journey of discovery.

For my technical writing students, rapid in-class writing and extensive peer review leads to prose that is concise, less bloated with personal narrative or extraneous discussions, more focused on the needs of an audience trying to assimilate complicated information. As students become immersed in the typical stream of proposals, progress reports, and final reports that defines any scientific or engineering project, they develop a more useful language for interpreting complex material and for suggesting revisions in a professional, collegial manner.

To put it bluntly, I feel that at the end of the semester more of my students are writing as adults: securing the reader's interest and expressing themselves maturely. No technology will ever replace imagination, depth of experience, and engagement as the best teaching "tools." But the electronic classroom helps to create an environment in which students and teachers can interact and exercise their intelligence and creativity more freely than ever before. Properly designed, it can fulfill our expectations of what a university can and should be, a place for exchanging information and ideas in the personal and social construction of knowledge.

After only six years, however, it is painfully clear how much more we could do to improve online teaching. From the beginning we have worried about ease of use, although such a concern is sometimes viewed with suspicion at MIT. It's a sign of weakness to a programming jock who wants to find the most secret passageway within the arcane interior world of the computer. But as computers become less remote from daily activities, users will disdain programmers who can't see that people and the tasks they want to perform are more important than "fascination with what's difficult" (the poet William Butler Yeats's phrase about writing poetry).

We also want the online environment to support a seamless interchange of course materials. People will demand greater access to online libraries: now they can search through online card catalogues, but soon they will want to call up text and graphics for quick review. And students are already complaining about elements of the network that impede access to one another, most often the fact that they don't have workstations in their rooms and must go to special facilities to write.

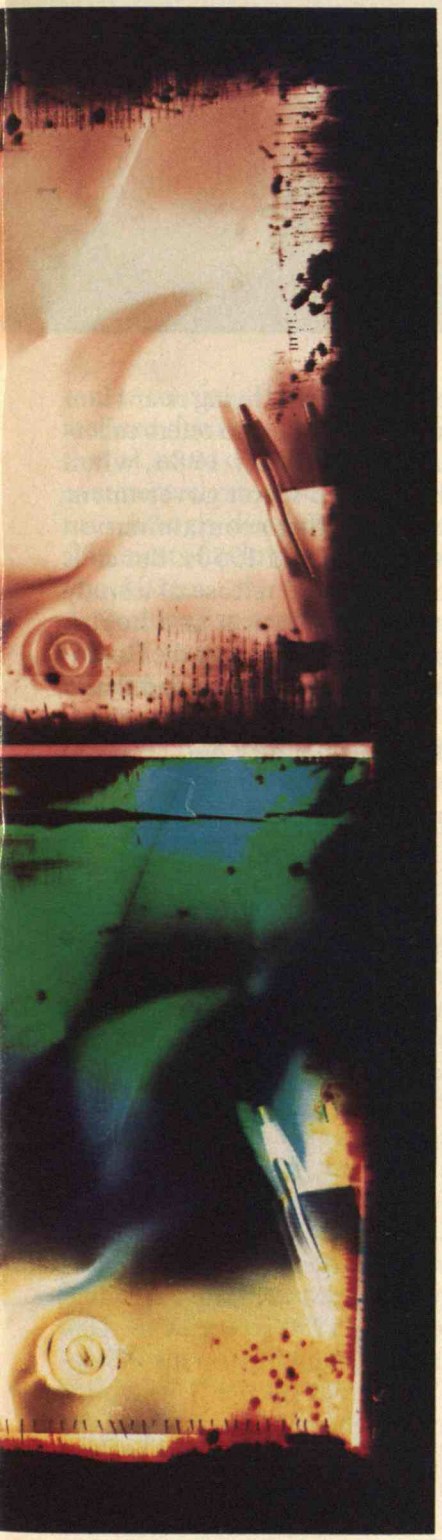
Nevertheless, the line between personal computers and mega-workstations is becoming finer with time, and it won't be long before we can plug into the grand electronic lattice from anywhere with any machine. Such an advance will bring us that much closer to what may be our highest goal—a means by which students can wander away (online) from the already disappearing four walls of any class, to synthesize some portion of the welter of disparate information that makes up the university in the first place. ■

Radiation Risks Revis



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By Len Ackland

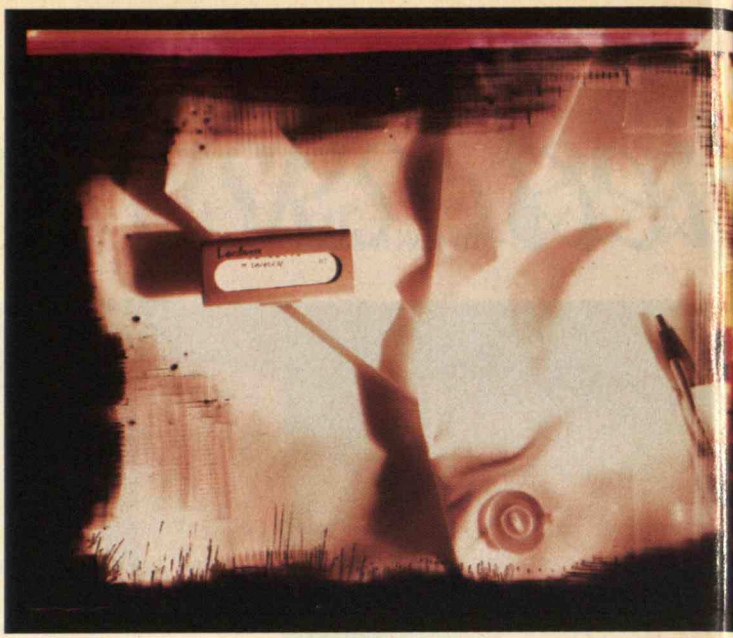


In the late 1970s, British epidemiologist Alice Stewart and her colleagues released a study claiming that workers exposed to low-level ionizing radiation at the U.S. government's Hanford nuclear weapons complex in Washington state had a heightened cancer risk. This troubling conclusion—with potentially far-reaching implications for radiation exposure standards, medical practices, and nuclear industry operations—ignited a major controversy.

Stewart, also known for a pivotal 1956 study associating x-rays in pregnant women with leukemia in their offspring, is about to refuel the dispute. An analysis by Stewart and statistician George W. Kneale, her longtime collaborator, soon to appear in the *American Journal of Industrial Medicine*, claims to further establish a connection between exposure of nuclear workers to supposedly safe doses of low-level ionizing radiation and the risk of contracting cancer.

Recent research could renew the bruising decades-long dispute over the health effects of low doses of ionizing radiation.

ILLUSTRATION: BRUCE ROGOVIN



THE Stewart team's findings are based on previously restricted Hanford data that the U.S. Department of Energy began releasing in 1990 to settle a lawsuit filed by the Three Mile Island Public Health Fund. The records include those of the 7,342 workers who died before 1987 and were employed at the plant between 1944 and 1978. These workers were among more than 35,000 men and women whose radiation doses were measured by film-badge monitoring during this period. According to contemporary radiation standards, these recorded exposures were safe. But Stewart and Kneale, using a new technique to more effectively isolate occupational doses from other causes of cancer, have calculated that approximately 3 percent of the 1,732 cancer deaths in the group resulted from workplace radiation exposure.

Calling this finding a "very conservative estimate," Stewart explains that its significance lies not in the number but in the fact that she and Kneale have found *any* positive correlation between the exposure of the Hanford workers and cancer deaths. Stewart says that "the nuclear establishment will be very upset" because it has claimed that the Hanford workers should manifest no observable effect based on extrapolations of the studies of Japanese atomic-bomb survivors.

Those studies, the basis for contemporary radiation-exposure standards, also concluded that myeloid leukemia, a bone-marrow cancer, was the only cancer that resulted from radiation exposure. Yet Stewart's team has found that occupational exposure to low-level ionizing radiation raises the risk of cancer in respiratory, digestive, and blood-forming tissues. The Japanese "had a single-dose situation with the atomic bombs," Stewart points out. "We have a more complex situation where people were exposed over a period of time." She adds that if the nuclear industry accepts her results, it would "have to recognize that even when they follow all regulations there still is a cancer effect."

Stewart has been doing epidemiological research on ionizing radiation for far too long to expect such recognition. But the findings come in an era of renewed public concern following widespread revelations about radioactive contamination at and near nuclear-weapons plants. Chris Sivula, a reporter at the *Tri-City Herald* in Pasco, Wash., located near the sprawling Hanford weapons complex, is likely to experience public reaction directly, as he has in the past: "Folks who lived here in the 1940s call me trying to find out if their cancer is related to living near Hanford." People began phoning Sivula, who refers callers to state health officials, in February 1986, when 19,000 pages of newly released secret government documents revealed chronic offsite contamination from Hanford during the 1940s and 1950s. But calls really poured in after the July 1990 release of a study by an 18-member panel of radiation and health experts headed by John E. Till, president of the Radiological Assessments Corp. The panel concluded that 5 percent, or 13,500, of the 270,000 residents in counties surrounding the Hanford facility had received "significant" amounts of airborne radiation during a three-year period ending in December 1947.

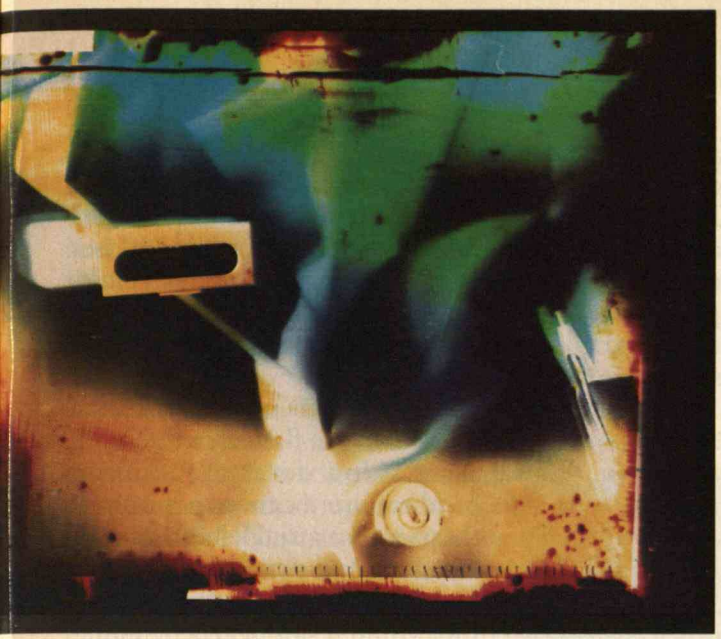
LEN ACKLAND, associate professor of journalism at the University of Colorado, is the former editor of the Bulletin of the Atomic Scientists. He *is working on a history of the Rocky Flats nuclear weapons plant.*

Atomic Bomb Survivor Studies

Public fears as well as scientific research on the health effects of ionizing radiation draw directly on the horrific events that introduced the world to nuclear weapons—the 1945 destruction of Hiroshima and Nagasaki. An unintended consequence of the bombings was the creation of a human laboratory for studying those effects. Epidemiologists have made considerable use of the health records of the more than 41,000 Japanese A-bomb survivors estimated to have received one-time high and medium doses.

These survivors are "the largest series of humans exposed to radiation for whom estimates of individual doses are available," notes the 1990 report by the U.S. National Research Council's Committee on the Biological Effects of Ionizing Radiations (BEIR). This report, regarded as the most comprehensive overview of the health effects of low-level radiation, is the fifth in a series and is commonly known as BEIR V (pronounced "beer 5").

The Japanese survivor studies have clearly shown the



EPIDEMIOLOGIST ALICE STEWART ARGUES THAT LOW DOSES OF IONIZING RADIATION RECEIVED OVER TIME CAN BE MORE HARMFUL THAN SINGLE HIGH DOSES.

cancer-causing effect of high doses of ionizing radiation received during a short period. They also demonstrate that at acute doses, the risk of excess cases of cancer over normal rates rises directly with the dose. But scientists strongly disagree over whether a linear relationship exists for low doses—defined as equal to or less than 10 rem.

Noting that nearly 20 percent of all deaths in the United States are caused by cancer, BEIR V uses extrapolations from the high-dose studies to calculate the excess cancer deaths from low doses of ionizing radiation. The report's rationale is that the population sizes involved in the Hiroshima and Nagasaki bombings are much larger than in low-dose exposures and are therefore less susceptible to statistical bias. The report estimates that if 100,000 persons of all ages received a whole-body dose of 10 rem of a deeply penetrating form of ionizing radiation in a single brief exposure, "about 800 extra cancer deaths would be expected during their remaining lifetimes in addition to the nearly 20,000 cancer deaths that would occur in the absence of the radiation." Thus the risk of inducing cancer—here from twice the annual dose that the U.S. Department of Energy allows for radiation workers—would be 1 in 125.

The BEIR V report acknowledges the uncertainty in calculating the probability that cancer will result from small doses. The causes and course of radiation-induced cancer are "complex and incompletely understood," it states. The risk of cancer depends on many variables, such as the sex of the person exposed and the magnitude of the dose to a particular organ. Moreover, cancers induced by radiation can't be distinguished from those produced by other causes.

The report is evoking criticisms of "too conservative" and "too liberal" at the same time. In the past year, a study by a team of scientists from Lawrence Livermore National Laboratory has challenged the data on

THE SCIENCE OF IONIZING RADIATION

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ALL human beings are bombarded by ionizing radiation from natural sources such as radon in the soil and cosmic rays as well as human sources such as medical diagnostic equipment. The behavior of this radiation—which unlike visible light and microwaves can knock off electrons from atoms, leaving charged atoms, or ions—depends on the emissions of radioactive elements' nuclei.

Each radioactive atom's nucleus, known as a radionuclide, has its own characteristic emissions composed of gamma rays or alpha or beta particles. A gamma ray—for instance, a cosmic ray—is an energetic, deeply penetrating particle that can be shielded only by dense materials such as lead or concrete. In contrast, an alpha particle loses energy over a short distance and can be stopped by materials such as paper or skin. But if it enters the body through ingestion or a wound, an alpha-emitting radionuclide such as plutonium can do considerable damage. Beta particles, another name for electrons, are regarded as less dangerous because they have less ability to transfer energy to atoms.

When ionizing radiation transfers its energy to a cell and knocks away orbital electrons that bond atoms into molecules, the cell can die and be expelled, it can be damaged and repair itself, or its genetic material can be changed. A mutation may initiate cancer. Or it may be passed to offspring.

According to estimates by the National Council on Radiation Protection and Measurements, an average resident of the United States receives an annual dose of .36 rem. (Short for "radiation equivalent man," a rem seeks to express on a common scale the biological effects of radiation.) Some 82 percent of that dose is natural—often referred to as "background" radiation—with the largest single amount, 55 percent, coming from radon. These estimated figures greatly underestimate doses received by smokers and do not take into account factors such as the higher doses of cosmic rays received by people who are living at high altitudes. Yet the numbers are widely regarded as the best estimates, given the information that is currently available.—*LEN ACKLAND*



Why Focus on Studies of Nuclear Workers?

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EPIDEMIOLOGICAL analyses of the effects of radiation have proliferated so much in the past two decades that James Ruttenber, an epidemiologist at the University of Colorado School of Medicine, has proclaimed that "there is an epidemic of epidemiological studies."

Ruttenber, previously with the U.S. Centers for Disease Control in Atlanta, is skeptical about the validity of those studies that have examined people living in the vicinity of nuclear facilities. He and two colleagues recently reviewed more than 40 such analyses spawned in the United States, France, and Canada after the Three Mile Island and Chernobyl accidents.

"So far, no study has produced a clear-cut answer as to whether or not there is an increased disease risk around nuclear installations," they write in the December 1991 issue of *Health Physics*. In almost all analyses, the methods that were used to conduct the work "were not adequate" for determining if the cause and the supposed effects were related.

Before a decision is made to perform an epidemiological study of an off-site population, Ruttenber said, scientists should complete a dose-reconstruction study—a thorough history of radiation releases and subsequent exposures of people living in the community. Because complete information is difficult to come by ("airborne particles don't travel by census tract"), many proposals to conduct epidemiological studies will be shown to be infeasible or of dubious scientific value. Dose-reconstruction efforts are now under way outside the Hanford nuclear weapons complex and the Rocky Flats weapons plant near Denver.

In contrast to such off-site studies, the work by Alice Stewart, Ethel Gilbert, and other epidemiologists focuses on the on-site exposures of nuclear workers. In Ruttenber's opinion, epidemiological studies of workers at nuclear facilities are "the best way to show the risks of ionizing radiation."

—*Len Ackland*

atomic-bomb survivors used by BEIR V to make its calculations. This study, published in the journal *Health Physics* in October 1992, argues that the excess cancers among Japanese survivors were caused by higher doses of radiation than previously estimated. If the results prove accurate, they will suggest that the current radiation standards based on extrapolation from the survivor studies are too stringent.

But Stewart and other researchers maintain that the atomic-bomb survivor studies are flawed in the other direction. She argues that low doses of radiation received over time produce more cancer per unit of exposure. She hypothesizes that a single high dose of radiation has a greater chance of simply killing cells, which the body can often lose without injury. But lower doses received over time could result in genetic mutations in cells that might survive and eventually become cancerous.

Stewart also criticizes the survivor studies by pointing out that they fail to account for the large numbers of bombing victims who died in 1945. Many survivors, she says, had "an exceptionally strong constitution (survival of the fittest)," which skewed the subsequent studies. The concept is similar to the "healthy-worker effect" that Stewart found in an earlier study analyzing Hanford data. Nuclear workers at Hanford underwent medical screens before hiring and represented a healthier group of people than the general population, she claims. Failure to adjust for that effect would understate the overall consequences of radiation exposure.

Setting Limits

Underground miners were the first workers recognized as radiation victims. Fatal lung disease was detected in ore miners in central Europe as early as the sixteenth century. By the twentieth century the disease was associated with radon, a naturally occurring inert gas that is a decay product of radium-226, itself a decay product of natural uranium-238. After uranium mining took off in the late 1940s to feed the nascent nuclear arms race, a U.S. Public Health Service study found excess lung cancer among miners on the Colorado Plateau. It turned out that two of radon's decay products have emissions that are highly damaging to lung tissue when the decay occurs after radon has been inhaled.

Meanwhile, deaths among pioneers in radium research and users of radioactive products in the early twentieth century had led to a growing awareness within the medical community of the dangers of other forms of ionizing radiation. But as journalist Catherine Caufield notes in her 1989 book *Multiple Exposures*, the first international safety guidelines, established in the late 1920s, were arbitrary. After World War II the

newly established U.S. Atomic Energy Commission (AEC) set a dose limit of 36.5 rem per year for occupational exposure. Today's international standard has been dropped to 2 rem annually, although the U.S. Department of Energy (DOE) standard remains at 5 rem.

When extrapolations from the initial studies of Japanese survivors did not indicate harm from low-level radiation, AEC contractors began urging a relaxation of standards—a move resisted by many medical researchers. In 1964 the AEC agreed to sponsor a study of nuclear workers and hired Thomas Mancuso, a physician, to conduct the research. He concentrated on workers at the Hanford complex, which began large-scale production of weapons-grade plutonium in 1944. By 1964 more than 20,000 workers had been employed in reprocessing operations that required constant film-badge monitoring as well as periodic tests such as urine exams. Mancuso began tracing records of dates and causes of death in an effort to determine whether the recorded radiation exposures had caused harm.

Mancuso eventually invited Alice Stewart and statistician George Kneale to assist him in analyzing the Hanford data. In 1977, publishing a mortality study of 2,184 male Hanford workers who had received mean annual doses of 1.6 to 2.1 rem, the three researchers concluded that between 6 and 7 percent of the cancer deaths probably resulted directly from the radiation, and that the period between exposure and disease usually exceeded 10 years.

Experts for the DOE, which had meanwhile replaced the AEC, swiftly rejected these findings. Ethel Gilbert (a senior staff scientist at Battelle-Pacific Northwest Laboratories in Richland, Wash.), who DOE had appointed chief scientist of the Hanford project, concluded in 1979 that despite a statistically significant correlation between dose and cancers of the pancreas and the bone marrow (multiple myeloma) in Hanford workers, "in view of the absence of such a correlation for diseases more commonly associated with radiation such as myeloid leukemia, as well as the small number of deaths in the higher exposure group, the results cannot be considered definitive."

The debate has continued like an endless Errol Flynn swordfight ever since. And while the disagreements between Alice Stewart and Ethel Gilbert have made for the most conspicuous duel among radiation epidemiologists, action has not been limited to their sparring. For example, the March 1991 issue of the *Journal of the American Medical Association* contains a study by University of North Carolina epidemiologist Steven B. Wing and colleagues of workers hired at Oak Ridge National Laboratory between 1943 and 1972. Among 1,524 deaths that occurred through 1984, the group found a 33 percent higher-than-expected leukemia mortality, as well as a 63 percent higher death rate among white males. Indicating surprise at these findings, the authors pointed out that their study included seven years of follow-up data not available to previous studies of Oak Ridge workers, so cancers with long latency periods were more likely to show up.

THE ONLY WAY TO UNDERSTAND THE RISKS OF LOW-LEVEL RADIATION IS THROUGH OPEN ACCESS TO INFORMATION SUCH AS EXPOSURE RECORDS.

Gilbert, in an article published in the October-December 1991 issue of *Occupational Medicine*, commented that the correlation between exposure and cancer in Wing's study was mainly limited to cancers of the lungs, pancreas, larynx, and bladder, which have been linked to smoking. "Thus, a smoking-related bias is a possible explanation for these findings," she found.

Stewart argues that the results of her latest study are unassailable because the technique she and Kneale have applied controls the major variables that could bias the findings. Most notably, her team has used job categories to group the workers into five social classes, which imply different education and income levels as well as lifestyles. This refinement, when used with the typical groupings of workers by age, sex, and other categories, has assured the researchers that they have compared radiation doses received by similar people. Stewart and Kneale's conclusion: low doses of ionizing radiation can cause cancer.

While the analytical technique employed by the Stewart team is bound to excite epidemiologists, the new study has much broader significance for the general public. It is the first study since the 1970s in which the Department of Energy gave independent scientists access—albeit reluctantly—to recent exposure data on the Hanford workers. Open access to such information across the nuclear weapons complex is the only way that researchers, and through them the public, can understand the risks of low-level ionizing radiation. The process toward openness haltingly began a few years ago under DOE Secretary James D. Watkins. It should be fully implemented under the new administration.■

JOHN M. DEUTCH

Conversion at the NSF?

THE winds of change are blowing through the nation's science establishment, inducing shivers of apprehension. Walter Massey, director of the National Science Foundation, announced last summer that NSF is reviewing its future direction. Massey recognizes that over the past two decades, it has become far more likely that advances in fundamental science and engineering research will lead to near-term commercial applications and that public support for science increasingly requires that research be relevant to the nation's economic performance—displacing the past implied connection between research and the technological imperatives of superpower rivalry.

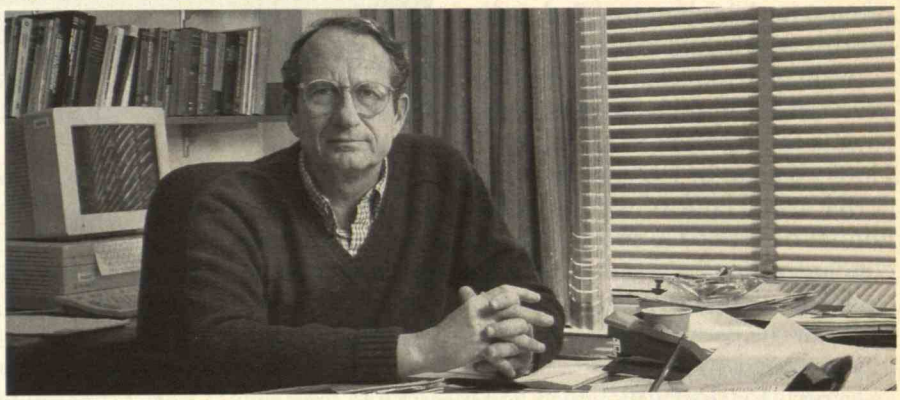
Academia is resisting this change. Within a month of Massey's announcement, a number of professors, deans, and university presidents expressed to me their horror at his ideas. They argue, with considerable merit, that the current basis of NSF support for university-based research has been extraordinarily productive. According to this traditional view, undirected basic research support provided by the NSF is the goose that lays the golden eggs. In due course, they say, such research breeds technological advances: support individual physicists and you will eventually get lasers.

I detect in my colleagues' opposition a fear of change. For three decades NSF has made decisions on research funding along disciplinary lines. University researchers have learned that recognition and promotion come most easily to those who do not deviate from the center of the disciplinary road. The rule has been "publish *in your discipline* or perish." A major change in the way NSF provides support would require a redefinition of research success, and this prospect frightens many who have become comfortable with the current system.

But a strict disciplinary focus has weaknesses. It offers researchers little incentive to consider the connections of their work with other disciplines and does not encourage the exploration of practical potential. Research collaborations between chemists and physicists or between chemists and chemical engineers are rare. And science and engineering faculty still turn up their noses at colleagues who work closely with industry—despite the intellectual and practical rewards that such collaboration can bring.

This narrow focus can sap a discipline's vitality. In my own field—chemistry—most researchers confine their studies within orthodox boundaries of organic, inorganic, and physical chemistry. They fill journals with research that I occasionally sense is leading nowhere. The field would be more relevant and exciting if chemists sought to link aggressively their work with that of other disciplines, such as materials science, biology, and chemical engineering.

Massey recommends that NSF integrate traditional and nontraditional types of research funding. NSF would support individual investigators within conventionally defined fields, but in ways that reduce the barriers between disciplines, encourage greater interaction between universities and industry, and emphasize the research's impact on the nation's economy. These changes would presumably be accomplished through greater emphasis on interdisciplinary research centers.



Massey's preference is based on the notion that a great deal of basic research can be applied relatively easily, and that the public deserves to enjoy the benefits of research as quickly as possible. He cites the opinion of Frank Press, president of the National Academy of Sciences. This "new reality," says Press, will entail a more "direct connection between fundamental science and engineering and their commercial applications."

Although many of the NSF activities ought to target some sort of economic benefit, we cannot abandon that portion of basic research that does not easily or quickly translate to useful technology. There remain some important intellectual endeavors—pure mathematics, astronomy, and high-energy physics, for example—that should be allowed to continue as before. They cannot and should not be forced into conforming to a new strategy of economic relevance. Massey should also resist the irresistible bureaucratic urge to use NSF's new strategy to justify higher budgets and set up false expectations in Congress about the certainty of resulting economic benefits. Most importantly, the danger exists that political forces will push NSF to lower its standards of technical merit in funding interdisciplinary work at engineering centers. Quality must not be compromised.

Still, change should be invigorating. Universities have traditionally had two fundamental purposes: to educate students and create knowledge. We are now presented with the opportunity to add a third objective of applying this knowledge to the real world. Past practice is not necessarily the best guide for future achievement. ■

JOHN M. DEUTCH, Institute professor at MIT, was formerly provost and dean of science. He has also been undersecretary and director of energy research of the U.S. Department of Energy.

PHOTO: L. BARRY HETHERINGTON

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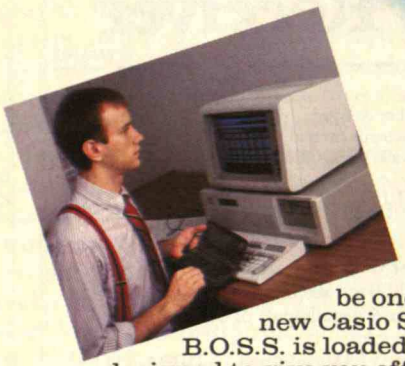
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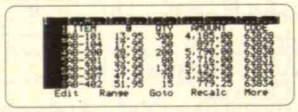
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The Indifference of Technocrats

DECAYING infrastructure, inept business leadership, industries in decline, ominous signs of social disorder—such was the American landscape reported in 1920 by renegade economist Thorstein Veblen. To save the nation, Veblen proposed a radical solution: remove control of economic affairs from businesspeople, whose quest for profit had driven them to irrational extremes. Instead, place power in the hands of engineers—a profession whose single-minded devotion to efficiency, he believed, would place the economy on solid foundations.

The notion that technical professionals would eventually govern society has been a recurring theme in American social thought. Such speculation raises an intriguing question: if technical elites were somehow to gain power, would they use that opportunity responsibly? In the 1960s, John Kenneth Galbraith argued that the question was no longer hypothetical. He identified a "technostructure" composed of technically adept managers that had amassed decisive influence within large U.S. companies. Unfortunately, in Galbraith's view, this group was squandering its authority. Rather than pursue the public interest, members of the technostructure merely advanced their own wealth and privilege.

A contemporary version of the technocratic dilemma is described in the recent writing of Harvard's Robert Reich, a long-time economic adviser of President Bill Clinton's and now his pick for Secretary of Labor. Reich describes a new social stratum that cuts across the global webs of transnational corporations. This class, the "symbolic analysts," consists of the scientists, engineers, architects, software developers, and other well-educated professionals who "solve, identify, and broker problems by manipulating symbols."

In Reich's portrait, symbolic analysts command premium salaries, live in lovely homes in safe neighborhoods, and send their children to good schools. They travel internationally and are everywhere connected by electronic communication. Their decisions determine where factories and offices are placed, which products are developed and marketed, and how millions of people make a living.

Because their work relations span the globe, Reich contends, symbolic analysts have begun to secede from their own societies. Primarily focused on their own technical projects and the profitability of their firms, they display attitudes of cosmopolitan indifference. They show little interest in solving the problems of the unemployed, poor, and disadvantaged. Self-interest leads them to resist government programs that might benefit the less well off because those programs would only raise taxes and lower their own incomes. The historical contrast is striking. From the sober, staunchly ethical engineers of Veblen's vision we arrive at the spectacle of a footloose, radically disengaged technical aristocracy whose loyalty to nation seems appallingly thin.



While the secession of technical professionals did not surface as an issue in last fall's campaign, hints of it are reflected in many Clinton policies. To fix the nation's economic malaise, Reich urges large public investments in R&D, numerous high-tech initiatives, rebuilding physical infrastructure, and steps to provide the American work force with good education and health care—all items high on Clinton's agenda. At first glance these measures seem entirely laudable, exactly the ones needed to build a sound economy in the long term. But an ominous light is cast on them in Reich's own book, *The Work of Nations*.

In the book's sobering analysis, the main purpose of the new public "investments" is to make the United States an attractive landing platform for free-floating global corporations and their symbol-wielding wizards. But Reich notes that there is no guarantee that the strategy will succeed. After all, other countries will be offering similar, perhaps even stronger inducements. Thus, "American" companies, run by "American" symbolic analysts, may gladly receive subsidies from back home but then—lacking any particular commitment to their country—decide to move most of their work elsewhere. Seen in this light, the U.S. public is in effect being held hostage, asked to spend billions of tax dollars in what may be a futile effort to woo individuals and organizations for whom the well-being of their own country is no longer a primary concern.

Questions about the loyalty of today's technological aristocracy hover in the background as President Clinton grapples with the country's economic troubles. For the time being, the new administration seems willing to indulge the ambitions of today's techno-corporate elites, sponsoring many of their pet projects. But eventually we will have to ask: How well do these new "investments" really serve the nation? And how do we hold their promoters accountable for the public good? ■

LANGDON WINNER teaches in the Department of Science and Technology Studies at Rensselaer Polytechnic Institute. He is author of, among other books, The Whale and the Reactor.

PHOTO: L. BARRY HETHERINGTON

Reviews

BOOKS

THE PRESIDENTS' ANALYSTS

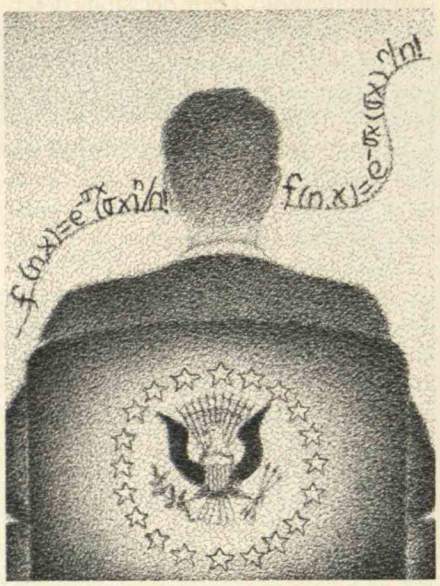
Cardinal Choices: Presidential Science Advising from the Atomic Bomb to SDI
by Gregg Herken
Oxford University Press, $24.95

BY DANIEL S. GREENBERG

SCIENCE advising at the top often resembles unrequited love. From the outset of World War II, U.S. scientists besieged the White House, insisting that whether or not the president realized it, he needed their help. More recently, scientific organizations have routinely exhorted incoming presidents to appoint a science adviser without delay. Yet except for brief spells under Eisenhower and Kennedy, scientists have never held a place in the inner circle of power.

In the everyday policy battles at the White House, scientists' win-loss record on major causes—from restraint on H-bomb development to vigor on efforts to curb global warming—is appalling. "You lose a few and you lose a few," a shell-shocked occupant of the White House science office once confided to me. On the record is the observation of Lyndon Johnson's science adviser, Donald Hornig, that "most of the White House staff . . . weren't sure why there was a science adviser or where [the science office] should fit in their scheme of things." Hornig, like his predecessors and most of his successors, came to office with nuclear-arms control at the top of his agenda. Johnson directed him to concentrate on "what science could do for grandma."

Veterans of the nation's science pinnacle have often memorialized their service in book-length accounts of vital participation in major events. In contrast, the memoirs of presidents generally depict these advisers as bit players, if they mention them at all. *The Memoirs of Richard Nixon*, 1,090 pages long, contains no mention of those who served him as science advisers. Nor does it discuss one of the most wrenching events in postwar relations between science and government: Nixon's sudden abolition of the science establishment's cherished inner sanctum, the White House Office of Science and Technology.



The strange minuet of science and politics is the subject of *Cardinal Choices*, a fascinating but sometimes unsatisfying book by Gregg Herken, chair of the Department of Space History at the National Air and Space Museum. Herken takes his title from C.P. Snow's formulation of the life-and-death "cardinal choices" that scientific developments require of modern leaders. He confines his explorations to one aspect of the link between science and government: scientific advice, both sought and volunteered, in the evolution of nuclear-weapons policy.

Mining newly opened archives and interviewing many of the major players, Herken is a sure-footed guide to the thoughts and actions of the relatively small group (predominantly physicists) who have advised the White House through long stretches of the postwar era. Unfortunately, the receiving end of such counsel is only lightly sketched. Of 54 people interviewed for the book, virtually all are barons of science.

Undermined or Ignored

As Herken shows, science got to the White House by repeatedly knocking on the door and proclaiming to the occupant: "You need us at your elbow to guide you through the dangers of the new atomic age." It was the alumni of the Manhattan project and other major wartime technological triumphs who sounded this message, eager to convince the novice incumbent, Harry Truman, that arms control was far less risky than an all-out arms race. Feeling that they alone knew the horrific potential of nuclear science, many urged Truman to refrain from a nuclear attack on Japan.

That episode was not the last time a president and his political cohorts failed to accept advice with the reverence that senior scientists regard as their due. Following the nuclear attacks on Japan, and the pell-mell rush, West and East, to develop hydrogen weapons, the two cultures repeatedly clashed as scientists fought for arms control in a political milieu inflamed by Cold War hysteria.

It did not help the scientists' cause that their advice was often baffling and contradictory. Under Eisenhower, the president's official advisers competed for attention with the nuclear alarms regularly showered on the White House by physicist Edward Teller and Lewis Strauss, chair of the Atomic Energy Commission. And a panel of scientists assigned by the White House to sort out the Soviet-American strategic balance recommended arms control coupled with a rapid missile buildup to counter reported Soviet advances. No wonder, then, that Eisenhower, according to an aide, felt that "every new survey of our problems by a scientific team seemed to result in recommendations that we undertake additional things." Upon leaving office, Eisenhower stunned his scientific advisers—newly ensconced in the 18-member President's Science Advisory Committee (PSAC)—by warning of

ILLUSTRATIONS: DAVE RIDLEY

the "danger that public policy could itself become the captive of a scientific-technological elite."

The Teller wing of nuclear science continued to undermine PSAC. Frustrated by both U.S. and Soviet intransigence toward a comprehensive nuclear test ban, PSAC returned to the cause in the Kennedy administration. But as had happened under Eisenhower, the opposition, led by Teller, proved too powerful and wily, particularly in generating fears of Soviet nuclear strength and aggressive intent.

Sincere but Naive

With the arms race thriving despite an atmospheric test ban, PSAC receded in presidential proximity and influence under Lyndon Johnson. He distrusted the Cambridge crowd that was so well represented on PSAC and bore grudges for certain members' opposition to the moon-landing program. Johnson was further enraged when two prominent former committee members, Jerome Wiesner and Herbert York, publicly warned that the arms race would lead "downward into oblivion," adding that "it is our considered professional judgment that this dilemma has no technical solution." After that, Johnson confined his science adviser, Hornig, to domestic matters.

The mismatch between science and politics had grown so troublesome that Nixon's choice for secretary of defense, Melvin Laird, said he would accept the post "only if PSAC were kept away from dealing with military problems," Herken reports. Summoned to the post of science adviser was one of the old-timers of the system, Caltech president Lee DuBridge, who had been a leading arms controller under Truman and Eisenhower. Welcomed at the White House during those administrations, he was pushed aside by Nixon's aides. Herken recounts that a visitor found DuBridge "alone in his office, his appointment calendar virtually blank." When DuBridge and Nixon's aides clashed over the creation of the Environmental Protection Agency, the aides told him, "You don't understand the politics of this thing." DuBridge replied that the environment was "a scientific problem, not a political one."

Nixon did not comprehend the scientists' sincere but naive belief that their function was to bring truth into the White House, regardless of the political ramifications. After PSAC publicly dissented on the supersonic transport plane—a high priority of Nixon's—one White House aide asked, "Who in the hell do those science bastards think they are?" And another declared, "Who needs this bunch of vipers in our nest?"

Whereupon Nixon swept science out of the White House by abolishing both the full-time science staff—the Office of Science and Technology—and PSAC. Profoundly shocked, the mandarins of science commenced a restoration campaign. Success came in 1975 with the creation of the Office of Science and Technology Policy (OSTP). Though a virtual clone of the previous White House science staff, it has since focused mainly on the care and feeding of science. A council of sages was created, but under Carter, Reagan, and Bush it has never measured up to the old PSAC.

Pining for a Golden Age

In the Reagan era, the Strategic Defense Initiative, the most ambitious technological undertaking of all time, came as a surprise both to Reagan's adviser, George Keyworth, and the pale, resurrected descendant of PSAC, the White House Science Council. Keyworth was at first appalled by SDI. But according to Herken, he quickly came around, telling a dubious aide, "This is a political decision, not a technical one, and in political things, you and I are not experts." After years of battering, political humility has settled over White House science advice.

Under Bush, the presidential science adviser has been elevated to the level of assistant to the president, but the title is bigger than the role. Bush's science shop has been almost wholly confined to domestic issues—mainly the support of science and the commercialization of technology, with ancillary duty in calming fears of global warming. Defense R&D, some 65 percent of the federal R&D budget, is not in its province.

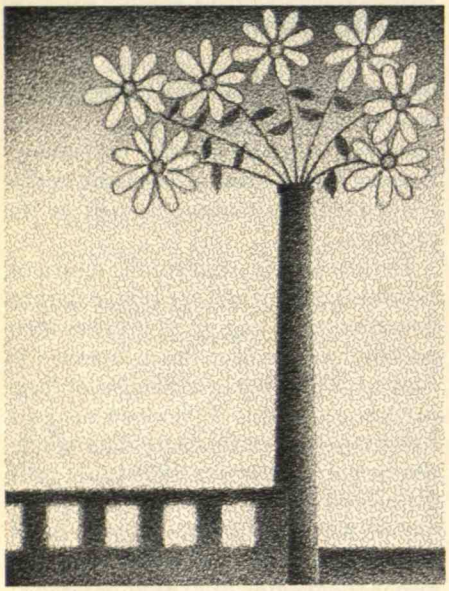
Herken openly pines for the return of a Golden Age of science advising that becomes more heroic as it fades into nostalgic recollection. But in fact the science advisers, even at the height of their influence under Eisenhower and Kennedy, were rarely more than minor characters in great dramas. Heady stuff for professors commuting to Washington—but in the end, the arms race raced on until the Soviet Union collapsed under the weight of its incompetence and misguided priorities.

While acknowledging that the Cold War atmosphere that spawned PSAC is long gone, Herken argues that "a strong science presence in the White House would provide the scientific equivalent of a medical second opinion on the cardinal choices facing the government." He adds that it could also be "the sponsor—and, if need be, the defender—of good ideas that otherwise lack a bureaucratic constituency in the government."

True, if the president so desires. But few have. And as Keyworth's experience showed, with insider status comes a commitment to political discretion and avoidance of public disagreement. While science advice should certainly have a berth at the White House, it must also flourish out in the open—under the sponsorship of professional societies and ad hoc groups of scientists—where Congress, the press, and the public can tune in.

Cardinal choices are too important to leave to a council of elders meeting in secret to advise a president who is not yearning for their advice.■

DANIEL S. GREENBERG, author of The Politics of Pure Science *(New American Library, 1971), is editor and publisher of* Science & Government Report, *a Washington newsletter.*



BOOKS

A GREEN MANIFESTO FROM BIG BUSINESS

Changing Course: A Global Business Perspective on Development and the Environment
by Stephan Schmidheiny with the Business Council for Sustainable Development
MIT Press, $35/$16.95

BY BRUCE SMART

In mid-1990 Maurice Strong, general chair of the United Nations Conference on Environment and Development, recruited Swiss industrialist Stephan Schmidheiny to be UNCED's adviser for business and industry. The popular view at the time was that industry, as the generator of much of the world's pollution, would show little interest in supporting the environmental improvements UNCED was promoting. *Changing Course* shows how wrong that view was.

Schmidheiny promptly organized the Business Council for Sustainable Development (BCSD), which eventually consisted of 48 corporate chief executives drawn from 26 countries and 5 continents. Their goal was to create a consensus position on global environment and development issues to be presented at the Earth Summit in Rio de Janeiro in June 1992. *Changing Course* is the fruit of that effort.

The picture of the business community that emerges from this document is one of rapidly growing environmental awareness, a commitment to play a major role in fostering sustainable development, and some strong convictions on how those changes can most efficiently be achieved. The book also challenges business leaders around the world to join in meeting the needs of the future instead of defending the status quo.

Industry's Environmental Ethic

That the concept of sustainable development is not new to many businesspeople is evident from most of the book's 38 case histories of corporate efforts to combine environmental awareness with economic efficiency. Since its founding in 1975, for example, 3M's Pollution Prevention Pays program, aimed at preventing waste at the source, has saved the company over $500 million.

Edgar S. Woolard, Jr., who became chairman and CEO of Du Pont in 1989, immediately declared himself the company's "chief environmental officer." He set goals such as cutting toxic air emissions by 60 percent in six years, and eliminating all toxic discharges to ground and surface waters. The company formed an Environmental Leadership Council consisting of senior executives supported by an environmental staff led by a corporate vice-president. Environmental performance is now a factor in determining managers' pay. And environmental activists have been invited to discuss their concerns with Du Pont managers and employees. Du Pont's progression from a reactive to an active approach to environmental problems serves as a road map for like-minded CEOs.

In the case of Volkswagen, a shortage of landfills put pressure on the company to recycle all automobile components, not just those made of steel. VW engineers now design not only for easy assembly and efficient performance but also for later disassembly and reuse of all materials. But they have found that environmental goals sometimes conflict. Making cars lighter to improve fuel efficiency—and thus air quality—requires more use of composites and plastics, which are harder to recycle than the steel they replace. VW has responded by establishing a pilot recycling facility at its plant in Leer, Germany, in collaboration with suppliers and the local chamber of commerce. The automaker's experience could ultimately prove useful in shaping future recycling regulations.

Sustainable development calls for economic progress as well as environmental protection, and multinational companies are obvious vehicles through which to diffuse technology and production skills to developing countries. When Shell Oil began operating in Nigeria in 1956, for example, local skills were minimal; all management and most skilled positions were filled by expatriates. Both to save costs and to build local competence, Shell introduced a program of training, education, and job rotation to prepare Nigerians to take over many of the positions originally held by outsiders. Today 62 percent of Shell-Nigeria's management and 90 percent of its employees overall are Nigerian. As an added benefit, many Nigerian employees who have left the firm are now putting their Shell training to use in government agencies, at other firms, or as entrepreneurs, further contributing to the country's economic progress.

From experiences like these, Schmidheiny and his staff have developed the meat of *Changing Course*, a series of chapters that define the environmental and developmental challenges and opportunities that confront global industry. A core issue is global energy policy. Here industry can contribute by boosting efficiency in the production and use of energy, and by converting to a more sustainable mix of energy sources.

Industry can play a major role in stemming population growth, as well, by contributing to greater prosperity in developing countries, by empowering women in the workplace, by educating the work force, and by developing new methods and products to aid in family planning.

Central to the authors' thinking is the concept of "eco-efficiency"—minimizing the environmental impact of creating goods and services. The authors argue strongly, even passionately, that eco-efficiency can work only if market forces are harnessed. They point out, in my view correctly, that without a mechanism for pricing environmental resources and processes now treated as "free goods," it will be difficult to regulate their use efficiently. If such resources are priced at full cost, markets can work for, rather than against, environmental protection.

Questions of Politics

Of course, achieving eco-efficiency requires more than good intentions. Perhaps it is unfair to ask this ambitious and forward-looking book to solve all the problems of sustainable development at one sitting; certainly the larger Rio meeting did more to propose a global agenda than to implement one. But however welcome *Changing Course* is as a business commitment, not much of this material is new to students of sustainable development, environmental economics, or corporate environmentalism. It is not the "what to do" that is lacking in much environmental policy thinking but the "how to do it." And here the issue becomes less one of science or economics or management—the authors' areas of expertise—than one of politics.

The politics of applying the recommendations of the BCSD, like those of countless other environmental reform groups, dissolves into a multitude of 64-dollar questions. If the environment is to be "priced," who is to set the prices? Who will collect the revenues? How will they be spent? If ecosystems and their components are a form of "property," who owns them? And who determines the trade-offs between their protection and other social goals?

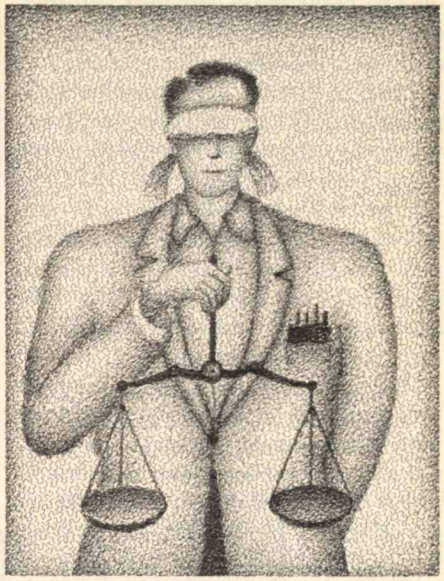
Sustainable development implies that a more equitable share of the world's economic pie must be made available to less developed societies, and that a better environment must be ensured for future generations. But if developed nations are to contribute to these goals, in what form are they to be compensated? Who pays how much to whom? And how can the political leaders of developed countries survive if they tax today's voters to provide for some future or foreign beneficiary?

Changing Course properly calls for greater cooperation among business, environmentalists, and governments. But how will old hostilities be muted? Can business be persuaded to accept environmental taxes when it already feels overtaxed? How can environmentalists cooperate with business without giving their supporters the impression they have been co-opted? How can governments cooperate in the face of popular opposition to any apparent ceding of sovereignty or outflow of tax monies?

Nevertheless, raising the questions *is* important. Like Rio, the book represents a key step along a hard road. Through the BCSD, business has asked for and received a place at the global environmental table. Its concerns are on the agenda. And for this accomplishment the council deserves high commendation.

Now it is up to a more broadly based successor group to pursue the task of making eco-efficiency a reality. The next difficult steps will be to devise the mechanisms, develop the public understanding, and generate the political will to make the behavioral, institutional, product, and process changes on which eco-efficiency and sustainable development depend. ■

BRUCE SMART, a senior fellow at the World Resources Institute, was undersecretary of commerce for international trade under Reagan and earlier was chairman and CEO of the Continental Group (formerly Continental Can Co.).



BOOKS

DOING RIGHT ON WRONGDOING

Impure Science: Fraud, Compromise, and Political Influence in Scientific Research
by Robert Bell
John Wiley & Sons, $22.95

BY ROSEMARY CHALK

ROBERT Bell says he has discovered how science really works: the U.S. research system is fueled by greed, corruption, fraud, and political patronage. Presenting a series of case studies derived mainly from congressional hearings on peer review, conflict of interest, whistleblowing, and scientific misconduct, the Brooklyn College economist claims that these instances are not simply aberrations but signs of a system that is out of control. He portrays the principal scientists in each case as stubbornly rebuffing "those who actually try to do anything about conflicts of interest and stand up for the integrity of scientific research." In the process, says Bell, the careers of

whistle-blowers are damaged, information is withheld, and the health of science—and the public—is impaired.

Impure Science is among the most recent entries in a genre of scientist-bashing books, perhaps the best known being *Betrayers of the Truth* (1982), by Nicholas Wade and William Broad. Although much of the scientific community dismisses such books as distorted polemics, their claims have caught the attention of several key journalists and members of Congress.

The cases presented in Bell's book are provocative: who can fail to sympathize with whistle-blowers who are punished for coming forward with claims of unfair or unsafe practices in science? Yet not all whistle-blowers are heroic figures who battle against conspiracies designed to cover up flaws, mistakes, and deliberate deceptions. And Bell's accounts overlook ambiguities that often explain why institutions made errors and poor judgments in these cases. The essential problem lies not in how to deal with corruption, but rather in how much weight scientists, research institutions, and government agencies should give to unsubstantiated charges.

TechnologyReview

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Questionable Cases

Peer review is one area that Bell singles out for scrutiny. This system—which relies on panels of experts, often anonymous—enables government funding agencies to assess at relatively low cost the scientific merits of thousands of research proposals each year and award billions of dollars in grants accordingly. Bell, like others before him, portrays peer review as the fox guarding the henhouse, claiming that the process can be distorted by political or personal bias. Although this charge may sometimes be true, the evidence he presents raises thorny questions he doesn't explore.

Consider the case of Jon Kalb, an anthropologist whose research mission in Ethiopia was denied funding by the National Science Foundation because of rumors about possible CIA affiliations. The rumors were unsubstantiated, and NSF officials later concluded that the allegations did not influence the grant decision (although others disagree). But how could such rumors have been investigated? Are accusations by themselves proper grounds for rejecting or tabling a scientific proposal? Credible arguments could be made on both sides, yet Bell leaves this ambiguity unresolved.

Perhaps the most disturbing accounts in *Impure Science* are those that involve allegations of fraud and misconduct. Although it is useful to be able to read these stories in one place without sifting through journal articles or transcripts of congressional hearings, observers who have been mystified by the twists and turns of the David Baltimore case will find little in the book to shed new light. The case concerns charges by a young MIT postdoc, Margot O'Toole, that immunology research conducted by her supervisor, Tereza Imanishi-Kari, did not support findings reported in an article coauthored by Imanishi-Kari, Nobel laureate David Baltimore, and others. Baltimore resigned as president of Rockefeller University following criticism of his response to the investigation of the charges.

Bell fails to probe key issues raised by the case: At what point should dissatisfaction with an interpretation of an experiment become a charge of misrepresentation or wrongdoing? How much evidence needs to be in hand to warrant a formal investigation or a finding of misconduct? When does the accused have a responsibility to demonstrate the accuracy of the experiments in question by replicating them? Since there are no hard-and-fast answers, subjective judgment can play a substantial role in matters like the Baltimore case when convincing evidence is lacking.

No Easy Solutions

Bell blames the funding agencies themselves for failing to root out conflict of interest, scientific misconduct, and overbilling of indirect costs. But here he makes the sweeping assumption that the problems are clear-cut, the solutions have been identified, and it is only a lack of political or moral will (within either the science establishment or the federal government) that prevents effective administrative, regulatory, or legal solutions from being implemented. The problems he presents require intricate balancing of costs and benefits and of certainty and uncertainty in considering charges of wrongdoing. The solutions to these problems have not yet been formulated, much less implemented.

In the interest of fostering public accountability, scientists are increasingly encouraged to come forward with suspicions and uncertainties about research that seems misleading or fraudulent. Yet universities, scientific societies, and government agencies are ill equipped to resolve the ambiguities that arise in complicated cases. In the meantime, both the accuser and the accused are left adrift, and the public is

left confused, frustrated, and cynical.

If one assumes, as Bell apparently does, that all charges of misconduct should be considered well founded until the evidence contradicts them, honest scientists will be forced to disrupt experiments and waste time refuting unfounded accusations. But the opposite approach seems equally unsatisfactory. If the whistle-blower is required to document charges of misconduct with solid evidence from the outset, few individuals will come forward with serious doubts about research findings.

What we need is a middle road, a mechanism that will screen frivolous charges but provide professional and institutional support for investigating well-founded concerns. An officer of a research institution, for example, might serve as a filter, dismissing complaints for which there seems no hope of obtaining evidence, and assembling ad hoc panels to examine more provable charges. Federal oversight is part of the solution as well. But the government should be a court of last resort rather than a primary arbiter of every allegation.

More important than focusing on the rights and wrongs in each case of alleged misconduct, government officials and scientific and academic leaders need to reach a consensus on the principles of accountability and standards of evidence that should guide the research enterprise. Having served as director of a National Academy of Sciences panel that wrestled with the ambiguities of misconduct policies and procedures, I can say that such consensus will probably require more time, and more cases, before it crystallizes. But the incentive for the science community to agree on standards and procedures could not be greater: if appropriate remedies are not found, the autonomy of scientists and their institutions will be diminished, and the costs of audits, standards, certifications, lawsuits, and bureaucracy will all take a toll on creative work.■

ROSEMARY CHALK is a policy analyst at the National Academy of Sciences in Washington, D.C., where she has directed several studies on scientific integrity and conflict of interest.

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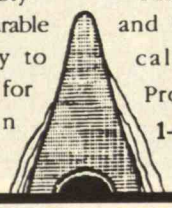
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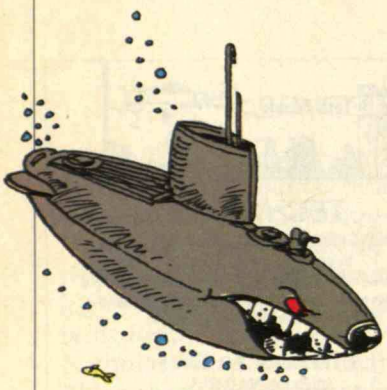
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Notes



Run Silent, Brush Teeth

Living aboard a submarine may take its toll on the psyche, but it may be even tougher on teeth. A recent study of some 400 Japanese submarine crew members found that 80 percent suffered from gum deterioration—compared to a national average of 34 percent—and that 32 percent had teeth from which the enamel had been completely worn away.

Dental researchers believe that hydrochloric-acid vapors from sub batteries may be responsible, UPI reports, as nearly two-thirds of those with enamel loss worked near the batteries. The researchers admit, however, that poor hygiene could be the real culprit. According to one hygiene specialist, "The duty rotation on a sub is such that the men often eat four meals a day," and they have dental problems because "they don't brush their teeth."

A Pox on the Gypsy Moth

Ever since the gypsy moth was accidentally introduced into Massachusetts by an amateur entomologist in 1869, conventional attempts to control its population have proven fruitless. The ravenous insect has caused untold timber loss as it spread from northeast states south to North Carolina and west to Michigan and beyond. Now a team of researchers led by H. Alan Wood, a virologist at the Boyce Thompson Institute for Plant Research in Ithaca, N.Y., has applied to the Environmental Protection Agency for permission to test an alternative approach involving a genetically engineered gypsy-moth virus.

The proposed experiment would take place in the spring of 1993 at Otis Air National Guard Base, in Cataunet, Mass., and would represent only the second field trial in the United States of a genetically altered insect virus. The first test, conducted by Wood in 1989, demonstrated how a virus that attacks the cabbage looper, a pale green worm that feeds on vegetables, could be genetically altered so that once it killed the pests the virus could not persist—to perhaps multiply or mutate—in a row-crop environment.

Wood's new team has similarly transformed the gypsy-moth virus by removing a gene that provides it with a protective coating, thereby hoping to limit its lifespan in a forest setting. "Even though the virus occurs naturally, we want to be sure it won't displace the normal virus population or create other environmental problems," says Wood. Once more is learned about the ecology of the deadly virus, Wood would like to alter it further to improve its effectiveness. One approach would be to enhance the virus's ability to target and attach itself to the gypsy moth's cell membranes, thus boosting its killing efficiency.



Eyewear: The Next Generation

Unlike the visor worn by Lt. Geordi La Forge on the popular television show *Star Trek: The Next Generation*, the headset recently developed by researchers at NASA and Johns Hopkins University cannot make the blind see. But it can do the next best thing. Called the Low Vision Enhancement System (LVES), the 16-ounce headset gives the visually impaired a view equivalent to that displayed on a 60-inch television screen if it were four feet from their eyes.

To produce the images, a tiny camera sends signals to cathode ray tubes (CRTs) in the arms of the headset. Small mirrors reflect the CRT images from the headset arms through prescription lenses and into the wearer's eyes. By turning a knob on a power pack worn on the belt, a person can adjust the contrast of the video image or magnify it several times.

The device is intended for people with visual acuity ranging from 20/100 to 20/800 in their better eye, say the researchers. When connected to a VCR or cable television, a person wearing the headset can sit with others and watch a show at a normal viewing distance. With the flip of a switch, the wearer can return to camera input and look about the room, then switch back to watching the television. A person can also connect the headset to a computer or compact videodisc player and read text on the screen.

The first commercial version, costing around $3,000, is expected in a couple of years, according to Robert Massof, director of the Lions Vision Center at Johns Hopkins' Wilmer Eye Institute. A more sophisticated version, now under development, will use computer chips to compensate for damaged areas of the retina, thus improving the vision of millions of people with macular degeneration and related eye diseases.



The Futz Factor

If you've ever wasted time at your computer trying to get the software to work or simply fiddling with some of its features, you're not alone. A recent study reveals that 25 million U.S. workplace computer users may average more than 5 hours per week "futzing." And there's a considerable price tag. SBT Accounting Systems of Sausalito, Calif., a producer of business software, estimates that this time-draining behavior costs U.S. businesses nearly $100 billion per year.

The SBT study suggests that most program puttering is fed by vendors who have responded to user requests by adding thousands of new features to software that was once relatively simple. Many new programs also come on the market every year, the study contends, which "puts users on a treadmill of new products that must be installed and learned."

To minimize futzing, the study recommends setting up user groups within a company, appointing an in-house expert for each major program, and creating a troubleshooting guide in which users can write down problems and their solutions.

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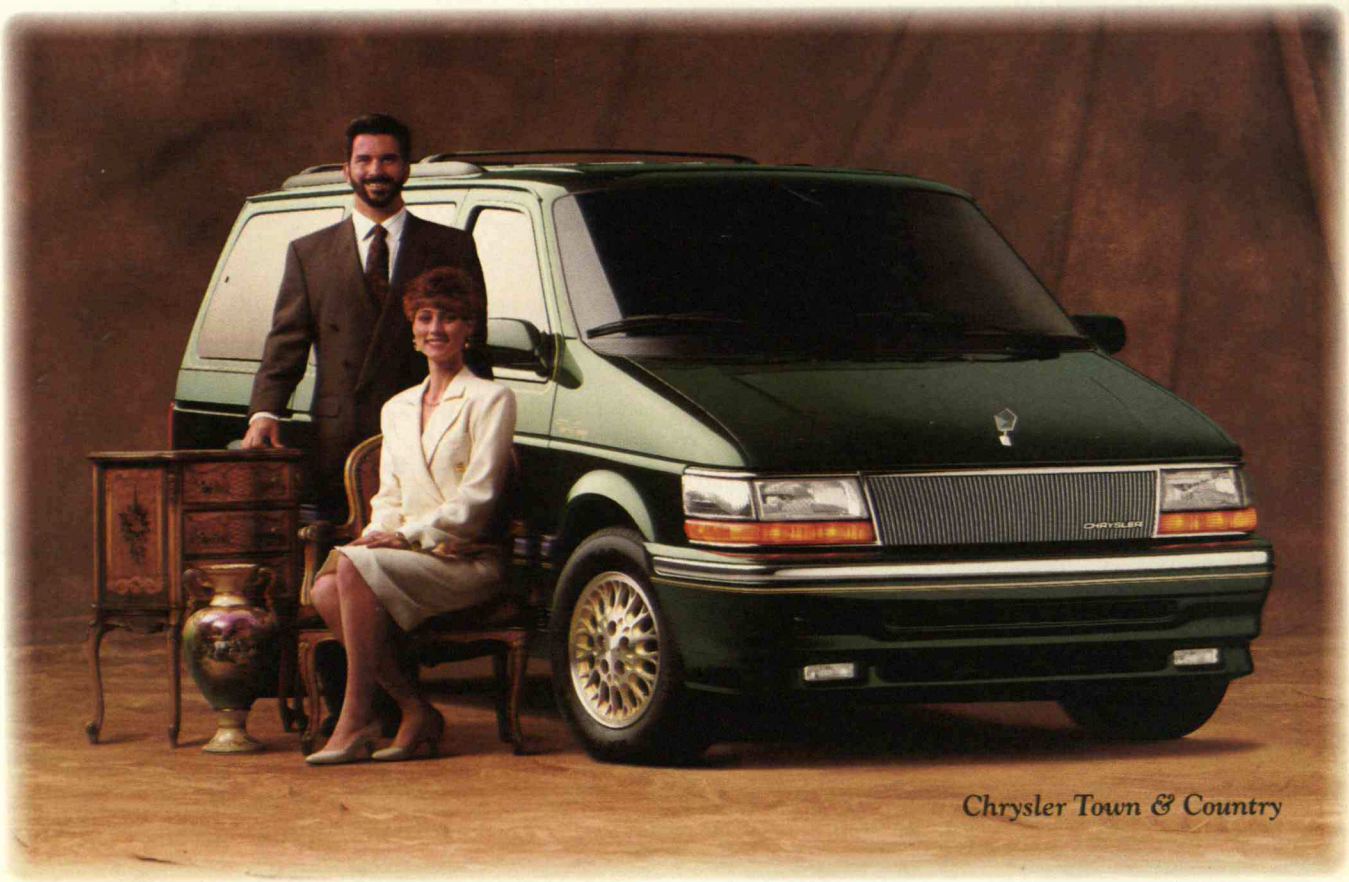
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